FIVE-YEAR REVIEW REPORT FOR BOARHEAD FARMS SUPERFUND SITE BUCKS COUNTY, PENNSYLVANIA

Prepared by

U.S. Environmental Protection Agency
Region III
Philadelphia, Pennsylvania

Ronald J. Borsellino, Director
Hazardous Site Cleanup Division
U.S. EPA, Region III

September 27, 2017
Date

[This page left intentionally blank.]

TABLE OF CONTENTS

TABLES

FIGURES

ATTACHMENTS

LIST OF ACRONYMS

ARAR	Applicable or Relevant and Appropriate Requirement
BCDOH	Bucks County Department of Health
CD	Consent Decree
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COPC	contaminant of potential concern
DCA	dichloroethane
DCE	dichloroethene
DMR	Discharge Monitoring Report
EE/CA	Engineering Evaluation/Cost Analysis
EI	Environmental Indicator
EPA	U.S. Environmental Protection Agency
ESD	Explanation of Significant Differences
FS	Feasibility Study
FFS	Focused Feasibility Study
GAC	granular activated carbon
gpd	gallons per day
GPRA	Government Performance and Results Act
MCL	Maximum Contaminant Level
NCP	National Contingency Plan
NPL	National Priorities List
O&M	operation and maintenance
OU	operable unit
PADEP	Pennsylvania Department of Environmental Protection
PADER	Pennsylvania Department of Environmental Resources
PCE	tetrachloroethene
PCOR	Preliminary Close Out Report
PRP	potentially responsible party
RAO	Remedial Action Objective
RAU	Ready for Anticipated Use
RI	Remedial Investigation
ROD	Record of Decision
RPM	Remedial Project Manager
SI	Site Inspection
TBC	to be considered
TCA	trichloroethane
TCE	trichloroethene
USACE	U.S. Army Corps of Engineers
USGS	U.S. Geological Survey
VOC	volatile organic compound
µg/kg	microgram per kilogram
µg/L	microgram per liter

EXECUTIVE SUMMARY

The final remedy selected by the United States Environmental Protection Agency (EPA) for the Boarhead Farms site in Bridgeton Township, Bucks County, Pennsylvania, included excavation and off-site disposal of buried containers and contaminated soils, on-site mechanical aeration of soils in two "hot spots" contaminated with volatile organic compounds (VOCs), construction and operation of a ground water extraction and treatment system, installation of monitoring wells along the Site perimeter to evaluate the potential for ground water to migrate off site, maintenance of filtration units installed on residential supply wells to prevent potential exposure to contaminated ground water, performance of treatability studies in former disposal areas to determine the applicability of phytoremediation as a viable ground water treatment method, and implementation of institutional controls to ensure long-term protectiveness. Construction of the remedy was considered complete with the signing of the Preliminary Close-Out Report on November 10, 2003. The action triggering this second Five-Year Review was the signing of the first Five-Year Review on August 22, 2007.

The assessment of this Five-Year Review found that the remedy was constructed in accordance with the requirements of the Record of Decision (ROD), signed on November 18, 1998. An Explanation of Significant Differences (ESD) was signed on April 15, 2009 to modify the remedial performance standard, or cleanup level for arsenic in ground water and to establish a cleanup level for vinyl chloride in ground water. The remedial action implemented for the soil/source portion of the site is protective. However, due to the presence of the VOC trichloroethene (TCE) in indoor air at the residence on the Boarhead Farms property at concentrations above Regional screening levels, a situation not anticipated in the ROD, the remedial action for the ground water portion of the site is not protective. Therefore, the Site will not be considered protective in the short-term until the risk to people living in the residence on the Boarhead Farms property has been reduced to acceptable levels. To achieve long-term protectiveness, steps should be taken to improve the capture of the ground water extraction and treatment system, to address contamination that has migrated beyond the system, to enhance the monitoring for 1,4-dioxane in ground water, and to revise and implement institutional controls.

Government Performance and Results Act (GPRA) Measure Review

The GPRA holds federal agencies accountable for using resources wisely and achieving program results. As part of this Five-Year Review, two environmental indicators (EI) and one land revitalization measure were reviewed. The status of these measures is presented below:

Performance Measure	Progress Category/Status
Site-Wide Human Exposure EI	Current human exposure not under control
Contaminated Ground Water Migration EI	Contaminated ground water migration not under control
Site-Wide Ready for Anticipated Use (RAU)	Conditions for Site-Wide RAU status have not been achieved

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site Name: Boarhead Farms		
EPA ID: PA047726161		
Region: 3	**State:** PA	**City/County:** Bridgeton Township, Bucks County

SITE STATUS	
NPL Status: Final	
Multiple OUs? Yes (two)	**Has the site achieved construction completion?** Yes

REVIEW STATUS
Lead agency: U.S. EPA
Author name (Federal or State Project Manager): Christopher Sklaney
Author affiliation: U.S. EPA Region 3
Review period: August 2011 – September 2012
Date of site inspection: January 17, 2012
Type of review: Statutory
Review number: 2
Triggering action date: August 22, 2007
Due date *(five years after triggering action date)*: August 22, 2012

Five-Year Review Summary Form (continued)

Issues/Recommendations

OU(s) without Issues/Recommendations Identified in the Five-Year Review:
None

Issues and Recommendations Identified in the Five-Year Review:				
Issue 1 (OU-1)	**Issue Category: Remedy Performance**			
	Issue: Concentration trends in sentinel monitoring wells suggest that capture of contaminated ground water by the extraction system wells is not complete			
	Recommendation: Evaluate additional measures to improve capture of contaminated ground water by the system			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA	12/31/13

Issue 2 (OU-1)	**Issue Category: Remedy Performance**			
	Issue: Site-related contaminants are present in ground water beneath adjacent properties at concentrations exceeding cleanup levels			
	Recommendation: Evaluate alternatives in FFS to address ground water contamination down gradient of and beyond the extraction system			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA	12/31/13

Issue 3 (OU-1)	**Issue Category: Monitoring**			
	Issue: TCE is present in indoor air at the residence on the Boarhead Farms property at concentrations exceeding the Regional screening level			
	Recommendation: Evaluate additional response actions			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
Yes	Yes	PRP	EPA	08/22/13

Five-Year Review Summary Form (continued)

Issues and Recommendations Identified in the Five-Year Review:				
Issue 4 (OU-1)	**Issue Category: Monitoring**			
	Issue: 1,4-Dioxane is present in ground water at concentrations exceeding the Regional screening level			
	Recommendation: Expand monitoring program to more comprehensively define the extent of 1,4-dioxane in ground water			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA	08/22/14

Issue 5 (OU-1)	**Issue Category: Monitoring**			
	Issue: Due to the large number of contaminants in ground water, performance standards for individual constituents may eventually be achieved while total contaminant concentrations may be above acceptable risk levels			
	Recommendation: A risk assessment of residual ground water concentrations should be conducted after all performance standards are achieved			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA	Upon achievement of all individual cleanup levels

Issue 6 (OU-2)	**Issue Category: Institutional Controls**			
	Issue: Institutional controls, which protect the integrity of the remedy components, have yet to be implemented; no institutional controls restricting use of contaminated ground water or limiting exposure to vapor intrusion are outlined in the ROD			
	Recommendation: Modify decision document to include restrictions on use of contaminated ground water and provisions for evaluating or limiting exposure to vapor intrusion; continue to work with PRPs and PADEP to revise and implement institutional controls			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	EPA/PRP	EPA	10/30/13

Five-Year Review Summary Form (continued)

Protectiveness Statements		
Operable Unit:	*Protectiveness Determination:*	*Addendum Due Date:*
OU-1	Not Protective	08/22/13
Protectiveness Statement: The OU-1 (ground water) portion of the remedy has been constructed as designed and is effective at treating ground water captured in the trench and pumped from the active extraction wells, although capture of contaminated ground water by the extraction system from former source areas is not complete. This portion of the remedy is not considered protective due to the presence of site-related contaminants in indoor air at the residence on the Boarhead Farms property at concentrations above Regional screening levels, a situation not anticipated in the ROD. The risk to people living in the residence on the Boarhead Farms property must be reduced to acceptable levels (Issue 3) to achieve protectiveness in the short-term.		
Operable Unit:	*Protectiveness Determination:*	*Addendum Due Date:*
OU-2	Short-term Protective	Not applicable
Protectiveness Statement: The OU-2 (soil/source) portion of the remedy currently protects human health and the environment. The immediate threats were addressed through excavation and off-site disposal of buried containers and contaminated soil. In order for the remedy to be protective in the long-term, institutional controls must be revised and put in place.		

Sitewide Protectiveness Statement (if applicable)	
Protectiveness Determination:	*Addendum Due Date:*
Not Protective	08/22/13
Protectiveness Statement: The remedial action implemented for OU-2 (soil/source) is protective. However, due to the presence of site-related contaminants in indoor air at the residence on the Boarhead Farms property at concentrations above Regional screening levels, the remedial action for OU-1 is not protective. Therefore, the Site will not be considered protective in the short-term until the risk to people living in the residence on the Boarhead Farms property has been reduced to acceptable levels. To achieve long-term protectiveness, steps should be taken to improve the capture of the ground water extraction and treatment system, to address contamination that has migrated beyond the system, to enhance the monitoring for 1,4-dioxane in ground water, and to revise and implement institutional controls.	

I. Introduction

The purpose of the Five-Year Review is to determine whether the remedy at a site is protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in Five-Year Review reports. In addition, Five-Year Review reports identify issues found during the review, if any, and identify recommendations to address them.

The U.S. Environmental Protection Agency (the Agency or EPA) is preparing this Five-Year Review Report pursuant to Section 121(c) of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and the National Contingency Plan (NCP). CERCLA §121(c) provides:

> *If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action.*

The Agency interpreted this requirement further in the NCP in the Code of Federal Regulations (CFR) at 40 CFR §300.430(f)(4)(ii) which provides:

> *If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.*

This is the second Five-Year Review for the Site. The action triggering this statutory review was the completion of the first Five-Year Review, which is documented as August 22, 2007. This review was conducted from August 2011 through September 2012 by the assigned Remedial Project Manager (RPM). This report documents the results of the review.

The Five-Year Review is statutorily required because the implemented remedy resulted in hazardous substances being left on the Site. Specifically, hazardous substances remain in the soils on the Boarhead Farms property at concentrations which do not allow for unlimited use and unrestricted exposure. In addition, until the long-term ground water recovery and treatment remedy achieves Site ground water cleanup standards, contaminants also remain in the ground water at concentrations which do not allow for unrestricted exposure.

II. Site Chronology

Table 1. Chronology of Site Events

Event	Date
State and local authorities investigate complaints of dead fish and plant life near the Boarhead Farms property.	1970
Bucks County Health Department obtains a warrant and conducts an inspection of the property. Identifies improperly stored chemicals and leaking drums.	1973
County fire department evacuates nearby residents due to sulfuric acid fumes emanating from the property.	1976
U.S. Environmental Protection Agency (EPA) conducts an investigation of the property.	1984
Boarhead Farms is added to the National Priorities List (NPL) of hazardous waste sites.	March 31,1989
EPA conducts a Remedial Investigation (RI) and Feasibility Study (FS), sometimes referenced collectively as an RI/FS, to identify the nature and extent of contamination remaining on site.	December 1989 – July 1997
EPA initiates an emergency response action which results in removal of numerous tanker trucks and over 2,600 drums containing hazardous substances, construction of a ground water extraction and treatment system, and installation of filters on 16 nearby residential drinking water supply wells.	1992
General Ceramics, Inc., a potentially responsible party (PRP), agrees to conduct a removal action under EPA oversight that included excavation and removal of drums and soils contaminated with radioactive wastes.	December 1992
EPA initiates start-up of the ground water extraction and treatment system designed by the U.S. Army Corps of Engineers (USACE), Omaha District, and constructed by IT Corporation.	August 12, 1997
EPA issues a Proposed Plan notifying the public of the preferred remedy.	January 5, 1998
EPA issues a Record of Decision (ROD) selecting the final remedy, which includes, among other things, ground water extraction and treatment, cleanup of contaminated soils, and removal of containers and drums containing hazardous wastes.	November 18, 1998
A Consent Decree (CD) is entered in Federal Court between the United States and a group of three PRPs. The CD provided that the PRPs would perform the ground water portion of the remedy, identified as Operable Unit (OU) One (OU-1).	September 29, 2000
PRPs assume operation of and implement operational changes to the ground water extraction system.	July 23, 2001 – August 17, 2001
PRPs perform upgrades to the ground water treatment system identified in the ROD.	January 16, 2002 – May 15, 2002

Table 1. Chronology of Site Events (Continued)

Event	Date
A CD between the U.S. and a group of four PRPs is entered in Federal Court. This second CD provided that the PRPs would perform the remaining remedial activities selected in the ROD that were not associated with the ground water portion of the remedy, including the cleanup of contaminated soils, removal of drums and other hazardous materials, and implementation of institutional controls. This portion of the remedy was classified as OU-2.	March 14, 2002
The PRPs conduct the cleanup of contaminated soils and removal of containerized hazardous materials.	April 14, 2003 – September 26, 2003
EPA, Pennsylvania Department of Environmental Protection (PADEP), and the PRPs conduct a site inspection and determine that the remedy for both operable units has been constructed in accordance with design specifications.	September 23, 2003
EPA issues a Preliminary Close-out Report (PCOR) indicating that the construction phase of the remedy has been completed.	November 10, 2003
EPA issues a remedial action completion report indicating that construction of the OU-2 portion of the remedy is complete.	May 28, 2004
EPA issues a remedial action completion report indicating that construction of the OU-1 portion of the remedy is complete.	August 20, 2004
EPA issues the first Five-Year Review.	August 22, 2007
EPA conducts the site inspection for the second Five-Year Review.	January 17, 2012

III. Background

Physical Characteristics

The Site is located at 1310 Lonely Cottage Road in the Bridgeton Township, Bucks County, Pennsylvania (Figure 1). The Site consists primarily of a property comprised of two parcels owned by the Boarhead Corporation totaling approximately 124 acres (Figure 2), herein after referred to as the Boarhead Farms property. Access to the Boarhead Farms property by vehicle is obtained solely through an unpaved road located an estimated 2,000 feet south of the intersection of Lonely Cottage Road and Bridgton Hill Road. A two-story residence, livestock stable, and a building containing the ground water treatment system are located on the property. A structure presumably used for storage by Keystone Excavation and a cellular phone tower is present west of the residence. Two man-made ponds are located east of the residence. The majority of the Site is forested, and the surrounding area is comprised primarily of residential, rural properties. The eastern portion of the Site is comprised predominantly of wooded wetlands. Lonely Cottage Road forms the eastern boundary of the property. The remaining boundaries of the site are located in the nearby forested areas and are not well defined by physical features. No man-made restrictions to access exist.

The Site is located near the eastern edge of a prominent regional upland area underlain by diabase, a medium- to coarse-grained, dark-gray, extremely hard crystalline igneous rock. Diabase has no primary porosity; water movement occurs through fractures in the rock. At the Site, the diabase is present in a broad sheet that covers about 18 square miles. Boreholes drilled in the vicinity of the Site indicate the diabase ranges from approximately 275 to 570 feet thick, generally thinning toward the east. Underlying the diabase are red and reddish-gray siltstones and shales of the Brunswick Formation. The bedrock system is covered by a thin sheath of clay-rich soil identified up to 14 feet thick at the Site (U.S. Geological Survey, or USGS, 1996).

The uppermost aquifer is the saprolite and weathered diabase within approximately 50 feet of the ground surface. Fractures in this zone are primarily located in the upper half and are locally filled with clay. The frequency of fractures decreases with depth. Hydraulic connections between fractures throughout the aquifer are generally poor. Hydrologic data collected during an evaluation of a limited number of boreholes drilled at the Site indicate that yields sufficient for domestic use are possible in certain fracture networks. However, no pattern for the spatial distribution of the fracture networks was identified. Several local potable wells are known to be drilled through the diabase and into the deepest aquifer, the sedimentary rock (predominantly shale and siltstone). Wells drilled into the sedimentary rock are most likely open in the diabase. The hydraulic head in the sedimentary rock aquifer is lower than in the diabase aquifer, indicating that ground water will have a tendency to move vertically downward in boreholes open in both units (USGS, 1996).

The soils are derived from diabase weathered to a buff-colored, granular sand and subsequently, to a sticky, red, montmorillonite-type clay. Montmorillonite clays are highly expansive in the presence of water and have a low permeability. At the Site, the clay-rich soils serve as a partial confining layer to the underlying weathered diabase aquifer (USGS, 1996).

The Site grades from a high of nearly 630 feet above mean sea level near the cellular phone tower to approximately 540 feet near Lonely Cottage Road. Natural overland drainage from the Site mimics the grade and is toward the east. An unnamed tributary of the Delaware River originates near the easternmost portion of the Site and is fed by several culverts which convey surface water runoff from the numerous wetland areas on the Site. The tributary flows through State game lands and a county park prior to reaching the Delaware River, an estimated 2.5 miles north of the Site.

Land and Resource Use

Use of the property is currently limited to activities associated with implementation of the remedy, and as a residence for people living in the single-family home located on the property. The local area is primarily residential and rural. Two junkyards south and northwest of the property are the sole known industrial facilities in the immediate area. Several parcels of Pennsylvania State game lands are within 0.5 miles of the Site. Two of the properties bordering the Site, the Bridgeton Township Sportsman Association (a gun club) and Camp Davis (a church camp), are recreational facilities. Bridgeton Elementary School and Bridgeton Athletic Association recreational fields are within one mile of the Site.

History of Contamination

Contamination at the Site was first identified by authorities in the early 1970s. The Pennsylvania State Police began receiving complaints of dead fish, dead plant life, and foaming along a stream on an adjacent property. The Bucks County Department of Health (BCDOH) investigated the complaints and observed pungent odors at the Site. The BCDOH reported a bulldozer on the Site burying old drums. The BCDOH also noted approximately 40 drums of unspecified solvents staged above ground, several drums aboard an open trailer, large empty tanks and empty tanker trucks.

On March 21, 1973, Boarhead Corporation and Mr. Manfred DeRewal entered an agreement with the Pennsylvania Department of Environmental Resources (PADER, now the Pennsylvania Department of Environmental Protection, or PADEP) to address environmental conditions at the Site. It was agreed that all industrial and solid waste, buried drums and contaminated soil would be removed. Storing of hazardous waste, land filling operations and parking of tanker trucks were banned. However, in October 1973, a neighbor reported discoloration and foaming in a stream on his property. The contamination was found to emanate from a leaking tanker truck on the Site carrying ferrous chloride. The entire volume of the tanker, approximately 3,000 gallons of ferrous chloride, had been discharged. Boarhead Corporation was found in violation of the Pennsylvania Clean Streams Law for releasing chemical waste without a permit.

Ground water and soil samples taken from the Site in July 1974 by a consultant hired by Boarhead Corporation revealed pH readings as low as 2.9. The presence of chloride, iron, chromium, copper, zinc, and nickel at unspecified concentrations were also noted. In April 1976, approximately 4,000 gallons of liquid ammonia were released from an open valve on a tanker truck. An ammonia odor was noted by the BCDOH in the open fields around the on-site residence, near the ponds, and on Lonely Cottage Road. In September 1976, another complaint about an ammonia odor was reported. The Bridgeton Police Department arrived at the Site and found a strong odor and a heavy fog by a storage tank. The tank contained sulfuric acid and had developed a leak, creating a sulfuric mist. As a result, thirty-four local residents were temporarily evacuated.

On October 15, 1976, the Court of Common Pleas of Bucks County issued an order to Mr. DeRewal and Boarhead Corporation prohibiting all chemicals from entering the Site in amounts greater than necessary for normal household use. All chemicals on the Site were ordered removed within seven days.

EPA conducted a site inspection (SI) of Boarhead Farms in May 1984 and issued a final SI report on January 20, 1986. The results of the SI were used to screen the Site for possible inclusion on the National Priorities List (NPL). The Site was added to the NPL on March 31, 1989.

Initial Response and Basis for Taking Action

In December 1989, EPA began a Remedial Investigation (RI) and Feasibility Study (FS) to determine the nature and extent of contamination associated with the Site. The investigation included sampling of soil and ground water on the Site, in addition to more than 100 residential water supply wells in the area. In August and September 1993, 35 monitoring wells (MW-1 through MW-35, consecutively) were installed as part of the RI. The RI was completed in January 1997 and the FS was completed in July 1997.

In 1992, EPA initiated an emergency removal action to address contamination at the Site. Activities included the removal of tanker trucks and drums containing hazardous substances; the construction of a ground water extraction, treatment, and monitoring system; and the installation of filters on residential drinking water supply wells. From 1992 through 1993, more than 2,600 buried drums were located, excavated, and disposed of at approved off-site disposal facilities. Over 6,600 cubic yards of contaminated soil was also excavated and disposed off-site. The excavated areas were covered with clean soil to reduce exposure risk.

In 1995, EPA completed an Engineering Evaluation/Cost Analysis (EE/CA) to evaluate alternatives for conducting a non-time critical removal action. The primary media of concern identified was ground water. The selected removal action alternative was recovery and treatment of ground water near the source areas and discharge to Pond 11, and point-of-use treatment at residential potable wells. Twenty-three exploratory wells (EW-1 through EW-23, consecutively) were installed in 1993 during field activities in support of the EE/CA.

In 1997, on behalf of EPA, the U.S. Army Corps of Engineers (USACE), Omaha District designed and constructed a ground water extraction and treatment system. The extraction system was designed to intercept and collect contaminated ground water from overburden through a trench and sump system and from bedrock by converting several of the exploratory wells installed as part of the EE/CA to extraction wells. EPA also installed granular activated carbon (GAC) filtration units on 16 residential water supply wells to prevent potential exposure to ground water contamination.

Analytical data compiled in the RI indicated that elevated levels of organic and inorganic substances were present in ground water, surface water, sediments and soil. Based on the conclusions of the RI, EPA determined that potential risks to human health and the environment were unacceptable and warranted additional remedial action.

IV. Remedial Actions

To assist in tracking the progress of various activities pursuant to the remedy, EPA separated the Site into two operable units, or OUs, at the time the final remedy was selected in the ROD. OU-1 includes operation of the treatment system and monitoring of contaminated ground water. OU-2 includes cleanup of contaminated soils, excavation and removal of containers of hazardous waste, and implementation of institutional controls.

Remedy Selection

The ROD was signed on November 18, 1998. The selected remedy was final, and outlined remedial action objectives (RAOs) developed from information gathered during the RI and FS. The RAOs were developed to eliminate or reduce the potential for hazardous materials associated with the Site to impact human health and the environment. The RAOs outlined by the remedy were:

- Reduce the potential for further migration of contaminants to the soil and ground water,
- Prevent current or future exposure to contaminated ground water, and
- Reduce the concentration of contaminants in ground water.

Principal components of the remedy selected to achieve the RAOs were:

- Soil aeration and treatment of soil at two "hot spots,"
- Excavation and off-site disposal of buried drums,
- Ground water extraction and treatment using precipitation and air stripping,
- Installation of additional ground water monitoring wells to monitor effectiveness of the remedial action,
- Maintenance of individual GAC filters installed on residential supply wells to prevent potential exposure to contaminated ground water (the filters were installed prior to issuance of the ROD),
- Performance of treatability studies in former disposal areas to determine whether phytoremediation is a viable treatment technique to aid in the removal of contamination from ground water, and
- Implementation of institutional controls to protect the integrity of the remedial action components and the previously installed cover soil.

On April 15, 2009, EPA issued an ESD that modified the remedy to 1) add vinyl chloride as a contaminant of concern and establish a cleanup level in ground water for vinyl chloride of 2 micrograms per liter (µg/L), and 2) modify the cleanup level for arsenic from 50 µg/L to 10 µg/L. The cleanup level was modified to reflect the new MCL for arsenic, which was formally adopted on January 22, 2001.

Cleanup levels were established for ground water and soil through the ROD and ESD. Cleanup levels were established for a subset of the contaminants of potential concern (COPCs) outlined in the RI. The cleanup levels selected in the ROD, as modified by the ESD, are outlined in Table 2.

Table 2. Remedial Cleanup Levels

Media	Contaminant	Cleanup Level [a]
Ground Water	Arsenic	10 µg/L
	Benzene	5 µg/L
	Beryllium	4 µg/L
	Cadmium	5 µg/L
	Chromium (total)	100 µg/L
	1,1-Dichloroethane (1,1-DCA)	27 µg/L [b]
	1,1-Dichloroethene (1,1-DCE)	7 µg/L
	cis-1,2-Dichloroethene (cis-1,2-DCE)	70 µg/L
	Ethylbenzene	700 µg/L
	Lead	5 µg/L
	Nickel	100 µg/L [c]
	Tetrachloroethene (PCE)	5 µg/L
	1,1,1-Trichloroethane (1,1,1-TCA)	200 µg/L
	Trichloroethene (TCE)	5 µg/L
	Vinyl chloride	2 µg/L
	Xylenes (total)	10,000 µg/L
	Zinc	2,000 µg/L [c]
Soil	Benzene	500 µg/kg [d]
	TCE	400 µg/kg [e]

[a] For ground water, equivalent to Federal MCLs as promulgated under the Safe Drinking Water Act at 40 CFR §§ 141.11, 141.12, 141.61, and 141.62, except where noted.

[b] Risk-based inhalation numeric value as outlined by Pennsylvania's Land Recycling and Environmental Remediation Standards Act (35 P.S. §§ 6026.101 through 6026.909), also known as Act 2.

[c] EPA-established health advisory estimate of acceptable drinking water levels for a chemical substance based on health effect information.

[d] Statewide soil-to-ground water numeric value as outlined by Act 2.

[e] EPA risk-based numeric value established in the Site-specific risk assessment.

Remedy Implementation

The remedy is being implemented by two PRP groups. The remedy for OU-1 is being implemented by Cytec Industries, Inc., Ford Motor Company, and SPS Technologies. The remedy for OU-2 is being implemented by the same three parties that comprise the OU-1 PRPs along with TI Automotive Systems Corporation.

Operable Unit 1 (Ground Water Portion of the Remedy)

The remedy for OU-1 includes the maintenance of residential filters, ground water monitoring, and operation and maintenance (O&M) of the ground water extraction and treatment system. The system was constructed for EPA by IT Corporation under the oversight of USACE as part of the EE/CA, and initially operated by EPA beginning in 1997.

The original design of the ground water extraction and treatment system was based largely on the engineering challenges associated with blasting and digging in the extremely competent diabase and the spatial location of physical features, such as the on-site ponds. The principal components of the system are the 1,500-foot-long interceptor trench, five collection sumps, and nine extraction wells. The trench varies in depth from approximately 7 feet to 14 feet deep and rests on top of bedrock. Ground water collected from the sumps and extraction wells is transferred to the treatment building through separate common headers.

As originally designed, ground water was extracted via pneumatic pumps and conveyed to the influent equalization tank. The treatment building housed a 7,000-gallon influent equalization tank, a shallow tray air stripping unit, and an air compressor. The two extraction system force mains discharged directly into the influent equalization tank. The discharge water was subsequently pumped to the top of the shallow tray air stripper as air was blown into the bottom of the air stripper. The air compressor was used for the pneumatic pumps located in the interceptor trench sumps and the extraction wells. The original system components are described in greater detail in IT Corporation's Final Report, dated December 2000.

On September 29, 2000, the PRPs assumed operation of the OU-1 portion of the remedy pursuant to a CD entered with the United States in Federal court (*U.S. v. Cytec Industries, Inc., et al.*, Civil Action No. 00-CV-2248). The PRPs retained de maximis, inc. (de maximis) to perform management of the remedy. Bigler Associates, Inc. (Bigler) was contracted to implement modifications to the system and perform on-going O&M. Brown and Caldwell was contracted to perform construction quality assurance and perform long-term monitoring of the remedy.

After assuming responsibility for the remedy, the PRPs conducted several modifications, including installation of a metals precipitation unit, an off-gas treatment system, and replacement of pneumatically powered pumps with electrically powered pumps. These changes were implemented to improve the operation of the extraction system and decrease O&M costs. Construction of these system modifications began on July 23, 2001 and was completed on May 15, 2002.

The treatment system, as modified, has three main process streams: ground water treatment, vapor treatment, and utility water. The ground water treatment process includes the equipment necessary to effectively reduce contaminants from the extracted ground water to levels below parameters set forth in the PADEP Discharge Permit Equivalent. Ground water collected from the extraction wells and the interceptor trench sumps is pumped to a series of air sparge tanks. The vapors generated during this process are collected from the top of the tanks and are then processed through vapor-phase carbon units to remove VOCs prior to discharge to the atmosphere. The metals precipitation unit consisting of several chambers aligned in series

was added to remove metals from the water. Water from the air sparging tanks enters the various chambers where chemicals are added and mixing is conducted, as necessary, to promote metals precipitation. The sludge that ultimately forms is pumped into a filter press where it is further dewatered. After the sludge is pressed the solids are placed in shipping containers and disposed of at an approved facility. The liquids pressed from the sludge are discharged to the building sump and pumped back into the first air sparge tank.

The process water from the metals precipitation overflow tank is pumped through two greensand filters to remove suspended solids and dissolved manganese. Process water continues from the greensand filters to two carbon vessels piped in series. The carbon treatment units are utilized to remove any remaining VOCs and particulate matter prior to discharge from the effluent holding tank. The treated process water is collected in the effluent holding tank. Water drains from this tank through the discharge pipe to the outfall located east of the treatment plant. The treated water is also utilized for backwashing the greensand and carbon filters and for use in the utility water system. Treated process water contained in the effluent holding tank is utilized for non-potable water uses. A pressure tank and associated pumps are utilized to deliver non-potable water to convenient water locations around the building. This water is used for various duties including cleaning equipment. This water is also used for the emergency eyewash and shower station. A carbon filter and sediment trap located in line prior to the emergency eyewash and shower station ensures the cleanest water possible for emergency use. The upgrades discussed above are documented in the Remedial Action Report, dated August 20, 2004.

Additional Monitoring Well Installation

In October 1999, an EPA remedial contractor installed six overburden monitoring wells at the Site using direct-push drilling methods. Wells MW-36, MW-37, and MW-38 were installed east of the extraction trench and wells MW-39, MW-40, and MW-41 were installed northeast of the trench in the vicinity of monitoring well MW-23.

In 2001, the PRPs installed perimeter monitoring wells MW-42 through MW-48 along Lonely Cottage Road. The wells were installed in pairs, which each pair containing one well installed in overburden and one well installed in shallow bedrock. In July 2002, the PRPs installed nine temporary wells along three private access roads located east of Lonely Cottage Road and the monitoring well group comprised of MW-06, MW-26, and MW-32 to collect additional data regarding the possible migration of contaminated ground water. The wells were installed in overburden using direct-push drilling methods. The results of the investigation indicated that TCE and related chlorinated VOCs were present in the shallow water-bearing zone down gradient of the well group with the concentration of TCE exceeding the cleanup level. Based on these findings, 12 additional permanent monitoring wells were installed in this area, including well RMW-37, a replacement for monitoring well MW-37. The wells were designated RMW-37 and MW-49 through MW-59, consecutively.

Beginning in June 2005, the PRPs continued to delineate the extent of the ground water contamination by installing additional monitoring wells. The investigation was conducted in three phases. The first phase involved the installation and sampling of six temporary wells. The sampling results from these temporary wells led to a second phase which involved the

installation and sampling of three more temporary well points. Based on the results from the temporary wells, six new permanent monitoring wells were installed east of Lonely Cottage Road, down gradient from the monitoring well group comprised of MW-05, MW-29, and MW-35 to monitor possible movement of the edge of the ground water contamination plume. The wells were designated MW-60 through MW-65, consecutively. In November 2010, three monitoring wells, designated MW-66, MW-67, and MW-68 were installed in the area of Ponds 10 and 11.

The additional monitoring wells installed after issuance of the ROD have refined the understanding of the nature and extent of down gradient VOC contamination, and identified the existence of the "northern" and "southern" plumes.

Residential Filter Program

Installation of the original residential filtration systems began in January 1997 as part of an EPA emergency removal action. Individual potable well water treatment systems, consisting of two GAC units, were installed at 15 adjacent residential properties and at the on-site residence. The PRPs assumed responsibility for maintenance of the filters and monitoring of the residential wells in 2001.

Beginning in 2002, filters were removed from ten wells but left in place on five other wells, including the on-site potable well, due to the proximity of each well to the known extent of ground water contamination. The owner of one potable well declined the offer to have a filtration unit installed, but continues to participate in the monitoring program. Another owner asserts that their potable well is out of service and has not provided the PRPs access to collect samples or maintain the filtration unit since 1993. Residential potable wells are currently monitored on a semi-annual basis, typically in April and October.

Phytoremediation

In the summer of 2000, Brown and Caldwell prepared a study evaluating the applicability and cost of phytoremediation at the Site on behalf of the PRPs. The evaluation concluded that phytoremediation would not be a suitable technology to employ at the Site at that time for several reasons, including the cost above and beyond regular operation of the ground water extraction and treatment system, the incomplete remediation of source materials (present at the time), and uncertainty regarding the need to control air emissions.

<u>Operable Unit 2 (Soil Cleanup and Drum Removal)</u>

The OU-2 soil cleanup and drum removal portion of the remedy is being conducted pursuant to a CD with the United States which was entered in Federal court on March 14, 2002 (*U.S. v. Cytec Industries, Inc., Ford Motor Company, SPS Technologies, TI Group Automotive Systems* Corporation, Civil Action No. 01-CU-6109). The parties performing maintenance and monitoring of the remedy for OU-1 also conduct the work for OU-2.

The ROD required treatment of hot spot areas to remove high levels of VOCs from Site soils and excavation and off-site disposal of buried drums. During the design of the remedy, it was determined that, in lieu of on-site treatment, contaminated soils in hot spot areas should be excavated and disposed of at approved off-site disposal facilities rather than treated at the Site. Field activities necessary to implement the cleanup of contaminated soils and removal of drums began on April 14, 2003, and were completed on September 26, 2003. Initial activities involved conducting pre-excavation surveys to define the limits of the soil and drum removal. Two areas, designated as Soil Remedy Area 1 (SR-1) and Soil Remedy Area 2 (SR-2), were identified during the RI as VOC "hot spots." Area SR-1 was located northwest of the Boarhead residence, and area SR-2 was located north of the access road. Benzene and TCE were detected in these areas above the soil cleanup levels of 500 micrograms per kilogram (µg/kg) and 400 µg/kg, respectively.

In accordance with the design, the soils within each hot spot area were excavated to the depth where bedrock was encountered. The average depth to bedrock in SR-l was 7 feet and the average depth to bedrock in SR-2 was 7.5 feet. Post-excavation sampling was performed along the horizontal limits of the excavations to confirm the attainment of the soil cleanup levels. Soils were excavated, as necessary, until the cleanup levels were achieved. Since no soil remained in the bottom of either area, no samples were taken of the excavation floor. Soils were also excavated in areas of magnetic anomalies, where buried drums or other containers had been identified. As was done in hot spot areas discussed above, soils were excavated to bedrock. Conventional earthwork equipment was used to perform the remedial activities. However, a "toothless" bucket was utilized on the excavator to protect against puncturing of intact drums. Soils within 18 inches of drums, drum fragments, or other containers and soils with physical evidence of contamination such as staining or odor were excavated. The remedy required ex situ, on-site treatment of contaminated soils via mechanical aeration. As an alternative, the excavated soils were transported offsite for disposal at an approved facility. Area SR-1, Area SR-2, and the location of the magnetic anomalies are presented in Figure 3.

During the excavation of the magnetic anomaly areas, containers in various conditions were encountered including fragments, partial drums, intact drums, drum liners and five-gallon pails. Prior to removal from the excavation, contents of partial drums, leaking drums, intact disintegrated drums and bladders that were likely to break upon disturbing were drained and like materials, as determined by the on-site chemist, were combined into proper containers for characterization and off-site disposal. The drained drums and various fragments were placed into secondary containment (a large mobile plastic container). Drums that were full and could be removed without losing the contents were immediately over packed into secure containers. Several crushed "carboys" or large bladders were identified as possibly containing chromic acid. The bladders were removed from the excavation and placed into secondary containment. The associated soils were placed into roll-off containers and handled as hazardous soils. Liquid that collected in the bottom of excavations were collected and containerized. The liquids were subsequently sampled and sent off-site for disposal at an approved waste disposal facility.

Institutional Controls

Institutional controls are non-engineered administrative and legal controls that help minimize the potential for human exposure to contamination and protect the integrity of the remedy. The institutional controls are required by the ROD and are not yet in place. The PRPs are responsible for implementing institutional controls to restrict the use of the Boarhead Farms property. Hazardous substances remain in the soils on the property at concentrations which do not allow for unlimited use and unrestricted exposure. EPA and PADEP are currently working with the PRPs to determine the best mechanism to implement the controls outlined in the ROD.

In addition, no institutional controls exist to prevent exposure to site-related contaminants through the use of newly installed private wells, or through exposure from the intrusion of organic vapors into new or existing habitable structures in the vicinity of contaminated ground water.

System Operation and Maintenance

The PRPs continue to conduct long-term monitoring and maintenance activities according to the individual O&M plans approved by EPA. The primary activities associated with ongoing O&M at the Site include the following:

- operation of the ground water extraction and treatment system,
- inspections of the ground water extraction wells and trench sumps,
- collection of water level readings at extraction wells and trench sumps,
- influent testing of ground water extraction wells and trench sumps,
- sampling of ground water monitoring wells and residential wells,
- reporting of Site conditions including ground water sample analysis results and the operating efficiencies of the treatment system,
- regular inspection of the treatment system,
- review of computer-based controls and trend history,
- effluent sampling and Discharge Monitoring Report (DMR) preparation,
- maintenance of extraction/treatment system equipment in accordance with manufacturer requirements in O&M manual, and
- maintenance of residential filters.

Several problems were encountered during the initial system start-up period in 1997, including the failure of the system to attain the established discharge limits. Although improvements were made, the system was not able to meet all discharge requirements. The problems associated with the performance of the treatment system at the time of startup were thought to be related to the extremely high concentrations of VOCs in the ground water extracted during the initial operation period. O&M of the ground water extraction and treatment system was initially conducted by EPA, USACE and its contractors. On May 2, 2000, the PRPs assumed responsibility for all future O&M activities associated with the ground water extraction and treatment system. Since the system was upgraded in 2002, discharge limits for treated ground water, as established by PADEP, have been consistently achieved. O&M of the ground

water extraction and treatment systems is being performed in accordance with the *O&M Plan Manuals (Volumes I and II), October 2002*, prepared by Bigler. Ongoing O&M activities, including site inspections are summarized in progress reports submitted to PADEP and EPA. A recent DMR is included as Attachment 1.

The peak flow of the system is estimated at 50,000 gallons per day (gpd). Prior to system modifications, the average daily flow rate was approximately 21,000 gpd, with an estimated 60 to 80 percent of the flow derived from the trench. Following modifications, the average daily flow rate was approximately 20,000 gpd. The current average daily flow rate is approximately 16,000 gpd. Approximately six million gallons of ground water are extracted and treated annually. The volume of water varies based on the amount of precipitation the area receives throughout the year. On average, approximately 400 pounds of VOCs are removed annually.

Costs Associated with Site O&M Activities

O&M costs at the Site primarily include expenses related to: 1) operation and maintenance of the ground water treatment system components, 2) semi-annual ground water sampling and analyses of monitoring and residential wells, 3) maintenance of residential filtration units, and 4) annual vapor intrusion monitoring of the on-site and nearby residential structures. The 1998 ROD estimated the annual O&M costs of the remedy to be $463,900. This included costs associated with maintaining the soils treatment remedy, the ground water extraction and treatment system, long-term monitoring, and the residential treatment systems. From May 2000, when the PRPs assumed responsibility for O&M activities through July 2007, the annual cost for the OU-1 and OU-2 portions of the remedy were estimated to be $350,000 and $50,000, respectively. In the past five years, the average annual cost for the OU-1 portion of the remedy was estimated by the PRPs to be about the same ($350,000). The average annual cost for the OU-2 portion of the remedy was not available, but has decreased significantly since cleanup activities associated with that portion of the remedy are complete.

V. Progress Since the Last Five-Year Review

The first Five-Year Review was issued on August 22, 2007. The protectiveness statement in the first Five-Year Review indicated:

> *"The assessment of the Site…finds the remedy has been constructed in accordance with the requirements of the ROD and is functioning as designed. The immediate threats have been addressed though the excavation and disposal of buried drums and contaminated soil, and provision of filters on residential water supplies. Extraction, treatment, and monitoring of the groundwater are being conducted as required. However, a protectiveness determination of the OU1 groundwater portion of the remedy cannot be made until further information is obtained. This information will be obtained by taking the necessary actions to address* [six] *issues* [impacting short-term protectiveness]. *It is expected that these actions will take approximately 12 to 18 months to complete, at which time a protectiveness determination will be made. The cleanup of contaminated soils and removal of additional drums is complete, as such, the OU2 portion of the*

remedy is considered protective in the short term. Long-term protectiveness of the Site remedy will be verified by addressing [the three] *issues* [impacting long-term protectiveness] *and through the continued operation and monitoring of the groundwater recovery and treatment system."*

The issues and recommendations outlined in the first Five-Year Review, in addition to the actions taken to address the issues, are outlined in Table 3. The issues determined to impact short-term protectiveness and cause the deferral of the protectiveness statement were designated Issues 1, 2, 3, 4, 5, and 7 in the first Five-Year Review.

Table 3. Actions Since Last Five-Year Review

Issue	Recommendation/ Follow-up Action	Milestone Date	Action Taken and Outcome	Date of Action
1. Post-ROD sampling has confirmed that VOCs are present beneath adjacent properties at concentrations exceeding cleanup levels	Conduct evaluation to determine best method to address ground water contamination on adjacent properties	12/30/08	Extent of contaminated ground water on adjacent properties defined through continued monitoring program; additionally, a Focused Feasibility Study (FFS) was submitted by the PRPs proposing modifications to the remedy; EPA currently evaluating alternatives in FFS	07/20/10
2. Several residents regularly deny or do not respond to requests to access their wells or maintain their filters	Revisit access to certain residential properties for sampling and filter maintenance	08/15/08	At the request of EPA, PRPs documented attempts to contact non-responsive residents during each annual residential ground water monitoring round	10/2007
3. The cleanup level for arsenic in ground water was 50 µg/L; the MCL has been lowered to 10 µg/L	Adopt new MCL for arsenic as ground water cleanup level	08/15/08	Modified cleanup level to MCL in ESD	04/15/09
4. Site ground water cleanup levels do not include vinyl chloride, a primary contaminant of concern	Establish cleanup level for vinyl chloride	08/15/08	Established cleanup level of 2 µg/L in ESD	04/15/09

Table 3. Actions Since Last Five-Year Review

Issue	Recommendation/ Follow-up Action	Milestone Date	Action Taken and Outcome	Date of Action
5. EPA has recently become aware that many VOC-related sites also contain 1,4-dioxane, which is not treated by the same methods used to remediate VOCs	Add 1,4-dioxane analysis to ground water sampling program	08/15/08	Added to monitoring program in first round after first Five-Year Review (Oct. 2007) for a limited number of wells and the system effluent; compound continues to be included in monitoring program	10/2007
6. With multiple contaminants present in ground water, the potential exists for the remedy to fail to meet the acceptable risk range even if all performance standards are met	Perform risk assessment evaluating concentrations of total residual contaminants in ground water when all performance standards are met	To be determined	Not currently applicable; multiple contaminants of concern remain present in ground water at concentrations above performance standards	Completion required upon achievement of all cleanup levels
7. The potential for vapors from VOCs in ground water to migrate into residences on and near the Boarhead Farms property exists	Evaluate potential for vapors from contaminants in ground water to migrate into residences	02/15/09	Vapor intrusion evaluation conducted, followed by initiation of annual indoor air monitoring program; results indicate the residence on the Boarhead Farms property is impacted by intrusion of vapors at levels above Regional screening levels	12/2008
8. The ROD indicated that the cleanup of soils, drums, and ground water should contribute to the protection of surface water, although this has not been confirmed through sampling	Evaluate contaminant concentrations in surface water	08/15/08	Surface water and pore-water sampling conducted; results indicate surface water is not being impacted	12/2008
9. Institutional controls, designed to protect the remedy and restrict use of the Site, have not been implemented	Identify available mechanisms and appropriate stakeholders to implement institutional controls	08/15/09	Property owner unresponsive; working with PADEP and PRPs to enact institutional controls through other means	Not complete

Note: EPA was responsible for implementing issues 3 and 4. The PRPs were responsible for implementing issues 1, 2, 5, 6, 7, 8, and 9.

The information gathered and actions taken in response to the issues outlined in the first Five-Year Review provided resolutions to Issues 1, 2, 3, 4, 5, and 8. Issue 6 will be evaluated after all cleanup levels have been reached. EPA and PADEP are investigating different alternatives for implementing institutional controls (Issue 9). The results of information gathered in reference to Issue 7 indicated that the remedy was not protective due to the presence of TCE in indoor air at the residence on the Boarhead Farms property at concentrations greater than two orders of magnitude above EPA Region III screening levels.

VI. Five-Year Review Process

Administrative Components

EPA notified the PRPs and PADEP of the initiation of the Five-Year Review in the autumn of 2011. The Five-Year Review was conducted from August 2011 through September 2012. The review was led by Christopher Sklaney, EPA's RPM for the Site, and included participation by Alexander Mandell, the Community Involvement Coordinator, and members from the regional technical and legal staff with expertise in the application of applicable or relevant and appropriate requirements (ARARs) and risk assessment. A Site-specific approach was developed for the Five-Year Review, which included:

- Community Involvement – Notifying the community that EPA is conducting a Five-Year Review at the Site and providing information on whom to contact and how to get more information about the process, and notifying the community of how to obtain a copy of the Five-Year Review Report upon completion;

- Interviews – Conducting interviews with responsible parties and local officials to determine whether these parties have any concerns regarding the Site.

- Document and Data Review – Reviewing all pertinent Site documents and environmental monitoring data. Researching ARARs cited in the ROD and subsequent modifications to the ROD, for revisions as well as identifying potentially new ARARs which may be significant to the Site circumstances. Checking available published toxicity references for Site-related contaminants to determine if there have been changes since the Site-specific risk assessment which may be relevant to the review team's evaluation of remedy protectiveness;

- Site Inspection – Visiting and inspecting the Site to visually confirm and document the conditions of the remedy, the Site, and the surrounding area; and

- Preparing the Five-Year Review Report and coordinating the review by team members and management.

EPA will continue to perform reviews every five years because the selected remedy relies on the combination of containment and institutional controls to prevent exposure to contaminated soils and ground water that remain on the Site and which have contaminant concentrations which do not permit unrestricted use.

Community Involvement

On March 26, 2012, a notice was published in the Lehigh Valley regional daily newspaper *The Morning Call* notifying the community that EPA was conducting a Five-Year Review at the Site. The notice included a brief overview of the response actions taken at the Site, and the reason that a review is necessary. The notice listed who to contact and how to get additional information related to the Site. In addition, the notice identified when the review was scheduled to be completed and stated that once completed, a copy of the review report would be available at the EPA Public Reading Room at 1650 Arch Street in Philadelphia, Pennsylvania, or over the internet at http://loggerhead. epa.gov/5yr/search.

Document Review

The Five-Year Review included a review of relevant Site documents and monitoring data, including the RI/FS, ROD, ESD, PCOR, O&M reports, and technical reports.

Data Review

Ground Water Monitoring

The remedy was designed to capture contaminated ground water in the overburden using the trench and in bedrock using the extraction wells. At the time the ROD was issued in November 1998, analytical data indicated that the extent of ground water contamination down gradient of the extraction system was limited and concentrations were near established cleanup levels. The installation of additional monitoring wells, required as a component of the remedy, identified contamination at higher concentrations in new areas, namely the "northern" and "southern" plumes.

The primary contaminants continuing to impact ground water quality are VOCs. The two identified plumes of contaminated ground water extend from the former source areas east to a location east of Lonely Cottage Road. The northern plume flows east-northeast and the southern plume appears to trend southeast before turning in a more easterly direction. An area of contaminated ground water without a distinct down gradient plume is located north of the northern end of the trench near monitoring well MW-23 and Soil Remedy Area SR-2. Figure 4 represents the extent of ground water contaminated with TCE; other VOCs are generally present in the same areas.

Ground water monitoring has been conducted by EPA since the early 1990s and exclusively by the PRPs since October 2001. Monitoring currently includes a network of approximately 50 wells that are generally classified based on their location relative to the former source areas and treatment system. Source area wells are those located up gradient of the trench

and extraction well network where buried containers were identified and removed. Sentinel wells are located down gradient of the trench and extraction well network. Perimeter wells are located down gradient of the sentinel wells along the property boundary, a portion of which is comprised by Lonely Cottage Road and further down gradient on adjacent properties.

The majority of wells are completed in overburden, saprolite, or shallow bedrock (diabase). A few wells are installed in the lower portion of the diabase sill. No monitoring wells are installed in the sedimentary rock underlying the diabase, although many local potable wells intercept both formations. Some wells are constructed of polyvinyl chloride (PVC), while others remain as open boreholes. Most sentinel, perimeter, and off-site wells were installed as couplets or triplets, conceptually intercepting multiple horizontal flow paths at a single location. Ground water is monitored on a semi-annual basis for VOCs and inorganic elements in most wells; some wells are monitored on an annual basis for inorganic elements, free cyanide, and other water quality parameters. A subset of wells are monitored semi-annually for 1,4-dioxane.

Source Area

Source area monitoring wells include MW-12, MW-16, MW-20, MW-21, and MW-66 (Figure 3). Contaminant concentrations have declined overall in the past five years in wells MW-16, MW-20, and MW-21, although remain from one to several orders of magnitude above cleanup levels for most VOCs subject to performance standards. The signature of contaminants in the source area wells differs somewhat. While other VOCs are present at significant concentrations, wells MW-16 and MW-20 are dominated by the presence of TCE at nearly twice the concentration of any other single contaminant. In contrast, cis-1,2-DCE is the most prevalent contaminant in well MW-21, although TCE and 1,1,1-TCA are present at similar concentrations. Well MW-21is located approximately half way between extraction wells EW-13 and EW-15, which are 240 feet apart. The interceptor trench is absent in this area and no additional extraction wells are located down gradient, suggesting that the contaminated ground water is probably contributing to the southern plume. Contaminant trends for wells MW-16, MW-20, and MW-21 over the past five years are presented in Attachment 2.

Wells MW-12 and MW-66 are located west of Pond 10. Concentrations of TCE and 1,1,1-TCA have increased slightly over time in well MW-12, while other contaminants have remained steady or declined. In comparison to wells MW-16, MW-20, and MW-21, total VOC concentrations in well MW-12 are relatively low. Monitoring well MW-66 is located down gradient of well MW-12 and several former source areas. Preliminary results from two rounds of sampling in well MW-66 include TCE at up to 2,500 µg/L, 1,1,1-TCA at 800 µg/L, 1,1-DCE at 150 µg/L, and cis-1,2-DCE at 76 µg/L. It appears likely that contaminated ground water in this area is not being captured by the network of extraction wells or collection trench and may also be contributing to the southern plume.

Benzene has been detected at a concentration of up to 1,500 µg/L in monitoring well MW-21, but has not been detected in wells MW-16 or MW-20. Benzene has been detected at concentrations several times the cleanup level in the southern plume, but not in the northern plume.

Analysis for 1,4-dioxane in the source area was conducted in wells MW-12 and MW-21 over the past five years. Concentrations in well MW-12 were below or near the 1 µg/L reporting limit. Concentrations in well MW-21 decreased from 180 µg/L in October 2007 to 61 µg/L in October 2011. One round of sampling was conducted in well MW-20 in October 2008 and in well MW-66 in December 2010, where it was reported at concentrations of 14 µg/L and 2 µg/L, respectively.

Northern Plume

Three well groups are primarily used to monitor concentration trends in the northern plume: RMW-37/MW-53, RMW-38/MW-48, and MW-49/MW-50. Overburden well RMW-37 and shallow bedrock well MW-53 are sentinel wells located 250 feet east of the interceptor trench. Overburden well RMW-38 and shallow bedrock well MW-48 are sentinel wells located 530 feet and down gradient of the RMW-37/MW-53 pair. Overburden well MW-49 and shallow bedrock well MW-50 are perimeter wells located 500 feet east and down gradient of the RMW-38/MW-48 pair.

VOC concentrations in well pair RMW-37/MW-53 declined through 2008 before increasing around 2009. Concentrations of six VOCs subject to cleanup levels (TCE, 1,1,1-TCA, 1,1-DCE, 1,1-DCA, PCE, and vinyl chloride) increased through October 2011. This well pair is located 250 feet down gradient of the collection trench in an area along the southernmost portion of the collection trench where limited or no bedrock extraction occurs. Contaminant trends for wells RMW-37 and MW-53 over the past five years are presented in Attachment 3.

VOC concentrations in down gradient well pairs RMW-38/MW-48 and MW-49/MW-50 have exhibited decreasing trends since inclusion in the sampling program in 2001 and 2004, respectively. The total VOC concentration as of the October 2011 monitoring round in RMW-38 and MW-48 was approximately 800 µg/L in each well. TCE was the primary constituent, present at a concentration of 620 µg/L in RMW-38 and 650 µg/L in MW-48. Contaminant trends for wells RMW-38 and MW-48 over the past five years are presented in Attachment 4.

The combined total VOC concentration in well pair MW-49/MW-50 in the October 2011 sampling round was less than 100 µg/L, the majority of which was comprised of TCE in shallow bedrock well MW-50. Despite the overall decline of VOC concentrations in northern plume wells over time, fluctuations have been observed between adjacent rounds as great as several thousand micrograms per liter. In the last five years, the degree of these fluctuations has reduced in the RMW-38/MW-48 pair and ceased in the MW-49/MW-50 pair. Contaminant trends for wells MW-49 and MW-50 over the past five years are presented in Attachment 5.

Analysis for 1,4-dioxane was conducted in the northern plume in overburden well RMW-38 and bedrock well MW-50. Concentrations in well RMW-38 were variable, ranging from a high of 57 µg/L in October 2007 to a low of 17 µg/L in October 2010. The fluctuations in 1,4-dioxane concentrations are similar to those observed for the other compounds in well RMW-38. The maximum concentration of 1,4-dioxane observed in well MW-50 was 10 µg/L, with results from several rounds below the reporting limit.

Southern Plume

In the southern plume, concentration trends have been monitored through sampling of several well groups: MW-56/MW-57, MW-05/MW-35/MW-29, MW-60/61, MW-62/63, and MW-64/65. Overburden well MW-56 and shallow bedrock well MW-57 are located south of Pond 11 and 450 feet southeast of the southern end of the collection trench. Overburden well MW-05, shallow bedrock well MW-35, and deep bedrock (diabase) well MW-29 are located 950 feet south-southeast of the MW-56/MW-57 pair on the west side of Lonely Cottage Road. Well pairs MW-60/MW-61, MW-62/MW-63, and MW-64/MW-65 are located down gradient of the MW-05/MW-35/MW-29 triplet on the east side of Lonely Cottage Road. Preliminary results of samples collected from monitoring wells MW-67 and MW-68, in combination with sampling results from existing wells suggests that the southern plume is restricted to the area between the two newly installed wells.

VOC concentrations in well pair MW-56/MW-57 have exhibited increasing trends over the last five years, including a drastic increase in contaminant concentrations during the April 2010 sampling round of nearly five to ten times. For all contaminants, the increase began during the April 2009 or October 2008 monitoring event and increased during the successive interim events. A sharp decrease in contaminant concentrations occurred during the October 2010 event followed by a slight increase in April 2011. Concentrations increased in bedrock well MW-57 but declined slightly in overburden well MW-56 during the October 2011 event. TCE is the primary constituent, although the same group of chlorinated VOCs identified in the northern plume along with benzene is present. Concentration trends for wells MW-56 and MW-57 over the past five years are presented in Attachment 6.

In general, concentrations at the well group by MW-05/MW-35/MW-29 are significantly lower than at up gradient well pair MW-56/MW-57. Contaminants at or exceeding cleanup levels are limited to 1,1-DCE, cis-1,2-DCE, PCE, and TCE in shallow bedrock well MW-35. In the October 2011 event, TCE was approximately one order of magnitude over the performance standard and cis-1,2-DCE increased nearly 2.5 times. Concentrations of 1,1-DCE and PCE were equivalent to the cleanup level in the October 2011 event. All compounds in MW-05 are currently below cleanup levels, and no detectable concentrations have been observed in deep bedrock well MW-29. Concentrations in the well pairs down or cross gradient from MW-05/MW-35/MW-29 have been below cleanup levels for all constituents. Concentrations trends for the past five years for this well group are presented in Attachment 7.

Analysis for 1,4-dioxane was conducted in the southern plume in bedrock well MW-57 and overburden well MW 05. Concentrations in well MW-57 increased from below 1 µg/L in October 2007 to 20 µg/L in April 2010 before decreasing to 9 µg/L in October 2011. The only detectable concentration in well MW-05 was at a concentration of 1 µg/L in October 2011.

MW-23 Area

An indistinct plume of contamination is located in the vicinity of sentinel well MW-23, northeast of the northernmost extraction well (EW-11). Concentrations in well MW-23 have declined significantly since 2002. Contaminants currently impacting ground water quality in this

area are limited to cis-1,2-DCE, TCE, and 1,1,1-TCA, present at concentrations of 340 µg/L, 330 µg/L, and 280 µg/L, respectively. No additional sentinel wells are located to the north, in the presumed direction of ground water flow in this area, although no contaminants have been detected to date in perimeter well groups MW-08/MW-31/MW-25 or MW-46/MW-47 located along Lonely Cottage Road. 1,4-Dioxane was present at concentrations no higher than 2 µg/L in samples collected from well MW-23 in the last five years. Concentration trends for the past five years in well MW-23 are presented in Attachment 8.

Residential Monitoring Program

Four residential potable wells are currently part of the ground water monitoring and home filtration program, including the potable well on the Boarhead Farms property. A fourth off-site resident has not permitted EPA or the PRPs access to perform maintenance of the filtration unit or collect samples since 1993. Analytical results of samples collected prior to and after filtration indicate that the potable wells on properties adjacent to the Boarhead Farms property are not being impacted by site-related contaminants. The filtration units serve as a contingency. In October 2011, the most recent monitoring event for which reviewed data are available, TCE was present in the pre-filtration sample collected from the Boarhead Farms potable well at a concentration of 88 µg/L, but below the laboratory reporting limit of 0.1 µg/L in the post-filtration sample (the cleanup level and MCL for TCE is 5 µg/L). No other VOCs, inorganic elements, or 1,4-dioxane were detected above cleanup levels in any potable well.

Surface Water Monitoring

Surface water monitoring is not a part of ongoing O&M activities. In response to an issue identified in the first Five-Year Review, the PRPs conducted sampling of water in the soil or sediment directly beneath surface water bodies, i.e., pore-water, to determine if contaminated ground water was discharging and contributing to the degradation of surface water. Nine sampling locations were selected, including Pond 10 and Pond 11 (Figure 5). Sampling was conducted in December 2008 and January 2009 using passive collection devices buried in sediment just below the surface water-sediment interface. The samplers were left in place for approximately three weeks and submitted for analysis of VOCs.

Analytical results indicated that ground water was discharging to Pond 10 and Pond 11, with greater constituents and concentrations present in Pond 10. Five compounds were present in the sample collected from Pond 10 (PD10-1) at concentrations exceeding the EPA Region 3 Freshwater Screening Values. Two compounds were present in the sample collected from Pond 11 (PD11-4) above screening values. One compound was present at down gradient location UC1-1 at a concentration above screening values. The results indicate that contaminated ground water is migrating from ground water into Pond 10 and 11, and that contaminated ground water in the down gradient areas may be discharging into and impacting surface water quality. Pore-water analytical results from the 2008-2009 sampling event are presented in Table 4.

Table 4. Sediment Pore-Water Analytical Results, January 2009

Compound	EPA Region 3 Freshwater Screening Value	PD10-1 (Pond 10)	PD11-4 (Pond 11)	UC1-1 (No. Plume Near MW-49/50)	WT-3-1 (Near MW-23)
1,1,1-Trichloroethane	11	**87**	**17**	--	--
1,1-Dichloroethane	47	**70**	3	--	--
1,1-Dichloroethene	25	**25**	5	--	--
Benzene	370	3	6	--	--
Chloroethane	NE	50	--	--	--
cis-1,2-Dichloroethene	590	280	30	--	6
Methylene chloride	98.1	7	--	--	--
Toluene	2	**21**	--	--	--
Trichloroethene	21	**100**	**55**	**22**	9
Vinyl chloride	930	62	--	--	--

All results in micrograms per liter (µg/L). Values in **bold** indicate a result exceeding the Freshwater Screening Value as established by the EPA Region 3 Biological Technical Assessment Group (BTAG).
"NE" indicates no value has been established.
"--" indicates compound not detected above laboratory reporting limit.

Indoor Air Monitoring

The residence on the Boarhead Farms property and two nearby residences have been part of the vapor intrusion monitoring program since first conducted in December 2008. The program monitors residential structures that overlie or are in close proximity to areas of known ground water contamination to determine if vapors from the VOC plumes are impacting indoor air. Sampling of the indoor air, sub-slab soil vapor, and ambient air occurs annually in December or January. Analytical data indicates that the nearby residential structures have not been impacted by any site-related contaminants to date. Indoor air sampling results indicate that concentrations of VOCs, primarily TCE, have been present in the Boarhead Farms property residence at concentrations above the Regional screening level of 0.43 micrograms per cubic meter ($\mu g/m^3$).

A removal action was initiated by EPA Region III in 2009 to address the indoor air issue at the property residence. The basement sumps were cleaned and covered, maintenance of the sump pumps was conducted, and a discharge line to the ground water treatment system was installed. Post-upgrade sampling indicated that while the improvements have reduced TCE concentrations, the levels are still greater than two orders of magnitude above the screening level. As of September 2012, additional steps to mitigate TCE concentrations in the residence were planned as part of the removal action.

Summary

Ground water cleanup levels were established for 17 compounds, including ten VOCs and seven inorganic elements. Analysis conducted as part of scheduled monitoring includes numerous other VOCs, 1,4-dioxane, and inorganic elements. With the exception of benzene in the southern plume, aromatic VOCs (toluene, ethylbenzene, and xylene) are restricted to the former source area. 1,4-Dioxane was found in several wells where sampling occurred at concentrations above the EPA regional screening level for potable water of 0.67 µg/L; no MCL has been promulgated and no site-specific cleanup standard has been established. Inorganic elements are below cleanup levels at most locations. Chlorinated VOCs are the most prevalent contaminants of concern, and are present in the former source areas, down gradient of the collection trench and extraction system, and beneath adjacent properties at concentrations above cleanup levels. Though the concentrations are declining in most areas and the system continues to capture contaminated ground water emanating from the former source areas, increasing trends in both the northern and southern plumes suggest the remedy is not sufficiently preventing contaminated ground water from migrating away from the source areas. No contaminants were present in samples collected from nearby residential potable wells before or after filtration units. Several contaminants were present in the pre-filtration sample collected from the potable well on the Boarhead Farms property, although post-filtration sample results were all below cleanup levels. Sediment pore-water sample results indicate VOCs are discharging at low concentrations from ground water and entering Pond 10 and Pond 11, although concentrations were below State water quality criteria and far below concentrations identified in ground water near the ponds.

The residence on the Boarhead Farms property is being impacted by organic vapors migrating from ground water into the living space. Improvements to the basement sumps have caused a decline in organic vapors, although concentrations above Regional screening levels still exist. No other residential properties have been impacted by organic vapors originating from site-related contamination.

Site Inspection

On January 17, 2012, an inspection of the remedy was conducted. Persons present for the Site inspection included: Geoff Seibel of de maximis, Project Coordinator; Craig Coslett of de maximis, Alternate Project Coordinator; Dustin Armstrong, PADEP Project Manager; and Christopher Sklaney, EPA RPM. The ground water extraction and treatment system was operational and the treatment building appeared to be in good condition. The necessary remedial action completion reports, O&M manuals and health and safety plans are available on-site in the office of the treatment building. In addition to visiting the property where the treatment building is located, the EPA RPM toured the adjacent residential neighborhood. No major changes in land use were observed.

Interviews

By way of telephone calls, electronic mail, and personal correspondence, EPA informed the PRPs, PADEP, and several local residents of the upcoming conduct of the second Five-Year Review. PADEP expressed concern over the status of the ground water portion of the remedy. No additional issues were identified during the correspondence.

VII. Technical Assessment

Question A: Is the remedy functioning as intended by the decision document?

The remedy for OU-1 is not fully functioning as intended due to incomplete capture of contaminated ground water from the former source areas. O&M of the ground water extraction system continues to prove effective at removing and treating contaminated ground water. The extent of contaminated ground water is defined and monitored twice per year. Concentrations in most wells have continued to decrease in the past five years. However, increasing concentrations in some wells down gradient of the extraction and treatment system in the northern and southern plumes indicate capture of contaminated ground water by the trench and network of extraction wells is not complete. Several alternatives to address these plumes are being developed in the Focused Feasibility Study (FFS), which is currently under review by EPA.

No man-made restrictions preventing access to the property are present. Natural features and the rural setting of the property restrict vehicular access and most pedestrian access. No vandalism or other impacts to the physical features of the remedy have been observed, but the institutional controls called for in the ROD have yet to be implemented.

The soil cleanup and drum removal work (OU-2) is complete and was effective in removing the known sources of contamination.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy selection still valid?

Exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy selection are still valid. The cleanup level for arsenic in ground water was lowered from 50 µg/L to 10 µg/L to meet the revised MCL through the ESD issued on April 15, 2009.

Changes in Standards and Standards To Be Considered (TBC)

As part of this Five-Year Review, EPA reviewed the ARARs for the Site to determine if any significant changes in regulations, promulgated standards, or those "to be considered" (TBC) such as criteria and guidance had occurred, and if so, whether the changes impact the selected cleanup levels or protectiveness of the remedy. A comprehensive list of those ARARs identified for the Site is included in the decision documents. During the review, EPA did not identify any changes in regulations, standards, or TBCs that would call into question the protectiveness of the remedy.

The ground water and soil cleanup levels were derived in accordance with the requirement that remedial actions "at least" attain ARARs, including MCLs, and be protective of human health and the environment. The ground water cleanup levels meet the current federal and Pennsylvania state cleanup levels or MCL. Toxicity criteria have changed for TCE and PCE, and the methodology of calculating risk for TCE has changed. These changes do not significantly impact the remedy at this time, and will be evaluated after all cleanup levels have been reached. Soil cleanup levels for both Soil Remedy Areas were reached upon completion of the remedial action.

Changes in Exposure Pathways

The potential for VOCs in ground water to volatilize and impact human health by migrating into living spaces of overlying residential structures has been evaluated as a new exposure pathway by EPA. At the Site, the initial evaluation of this pathway was conducted during the winter of 2008-2009, and has been conducted each subsequent winter. Results of sampling from winter 2008-2009 through winter 2010-2011 indicate that the residence on the Boarhead Farms property contained concentrations of TCE in indoor air approximately two to three orders of magnitude above the Regional screening level. Steps taken to reduce the intrusion of organic vapors at the residence included improving and covering the sumps and conveying the collected water to the ground water treatment system. Samples collected in the winter of 2011-2012 after completion of the upgrades indicated that concentrations of TCE were reduced, but are still approximately two orders of magnitude over screening levels.

Changes in Toxicity and Other Contaminant Characteristics

No other changes to toxicity or other contaminant characteristics have occurred since the first Five-Year Review that could further impact the protectiveness of the remedy.

Changes in Risk Assessment Methods

Toxicity criteria have changed for TCE and PCE, and the methodology of calculating risk for TCE has changed. These changes do not significantly impact the remedy at this time, and will be evaluated after all cleanup levels have been reached.

Question C: Has any other information come to light that calls into question the protectiveness of the remedy?

No.

Technical Assessment Summary

The review of Site-related documents, risk assumptions, and results of the O&M reports and Site inspection suggests that the constructed remedy for OU-1 is not fully functioning as intended due to incomplete capture of contaminated ground water by the extraction system. Furthermore, the remedy is not protective of human health in the short-term due to intrusion of TCE into the living space of a residence at concentrations above Regional screening levels. The

institutional controls called for in the ROD have yet to be implemented. Cleanup levels for the two soil remedy areas were attained. Maintenance of filter systems on potable wells in conjunction with scheduled monitoring continues to ensure no one is exposed to contaminated drinking water. O&M activities continue on a regular basis for OU-1. Remedial work at OU-2 is complete.

VIII. Issues

Table 5. Issues

Issue	Affects Current Protectiveness (Y/N)	Affects Future Protectiveness (Y/N)
1. Concentration trends in sentinel monitoring wells suggest that capture of contaminated ground water by the extraction system wells is not complete	N	Y
2. Site-related contaminants are present in ground water beyond the extraction system and beneath adjacent properties at concentrations exceeding cleanup levels	N	Y
3. TCE is present in indoor air at the residence on the Boarhead Farms property at concentrations exceeding the Regional screening level	Y	Y
4. 1,4-Dioxane is present in ground water at concentrations exceeding the Regional screening level	N	Y
5. Due to the large number of contaminants in ground water, performance standards for individual constituents may eventually be achieved while total contaminant concentrations may be above acceptable risk levels	N	Y
6. Institutional controls, which protect the integrity of the remedy components, have yet to be implemented; no institutional controls restricting use of contaminated ground water or limiting exposure to vapor intrusion are outlined in the ROD	N	Y

IX. Recommendations and Follow-Up Actions

Table 6. Recommendations and Follow-Up Actions

Recommendation and Follow-Up Action	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness (Y/N)	
				Current	Future
1. Evaluate additional measures to improve capture of contaminated ground water by the system	PRP	EPA	12/31/13	N	Y
2. Evaluate alternatives in FFS to address ground water contamination down gradient of and beyond the extraction system	PRP	EPA	12/31/13	N	Y
3. Evaluate additional response actions	PRP	EPA	08/22/13	Y	Y
4. Expand monitoring program to more comprehensively define the extent of 1,4-dioxane in ground water	PRP	EPA	08/22/14	N	Y
5. A risk assessment of residual ground water concentrations should be conducted after all performance standards are achieved	PRP	EPA	Upon achieve-ment of all individual cleanup levels	N	Y
6. Modify decision document to include restrictions on use of contaminated ground water and provisions for evaluating or limiting exposure to vapor intrusion; continue to work with PRPs and PADEP to revise and implement institutional controls	EPA/PRP	EPA	10/30/13	N	Y

X. Protectiveness Statements

The OU-1 (ground water) portion of the remedy has been constructed as designed and is effective at treating ground water captured in the trench and pumped from the active extraction wells, although capture of contaminated ground water by the extraction system from former source areas is not complete. This portion of the remedy is not considered protective due to the presence of site-related contaminants in indoor air at the residence on the Boarhead Farms property at concentrations above Regional screening levels, a situation not anticipated in the ROD. The risk to people living in the residence on the Boarhead Farms property must be reduced to acceptable levels (Issue 3) to achieve protectiveness in the short-term.

The OU-2 (soil/source) portion of the remedy currently protects human health and the environment. The immediate threats were addressed through excavation and off-site disposal of buried containers and contaminated soil. In order for the remedy to be protective in the long-term, institutional controls must be revised and put in place.

The remedial action implemented for OU-2 (soil/source) is protective. However, due to the presence of site-related contaminants in indoor air at the residence on the Boarhead Farms property at concentrations above Regional screening levels, the remedial action for OU-1 is not protective. Therefore, the Site will not be considered protective in the short-term until the risk to people living in the residence on the Boarhead Farms property has been reduced to acceptable levels. To achieve long-term protectiveness, steps should be taken to improve the capture of the ground water extraction and treatment system, to address contamination that has migrated beyond the system, to enhance the monitoring for 1,4-dioxane in ground water, and to revise and implement institutional controls.

XI. Next Review

The third Five-Year Review for the Boarhead Farms site is required no later than five years from the signature date of this Five-Year Review.

[This page left intentionally blank.]

Figures

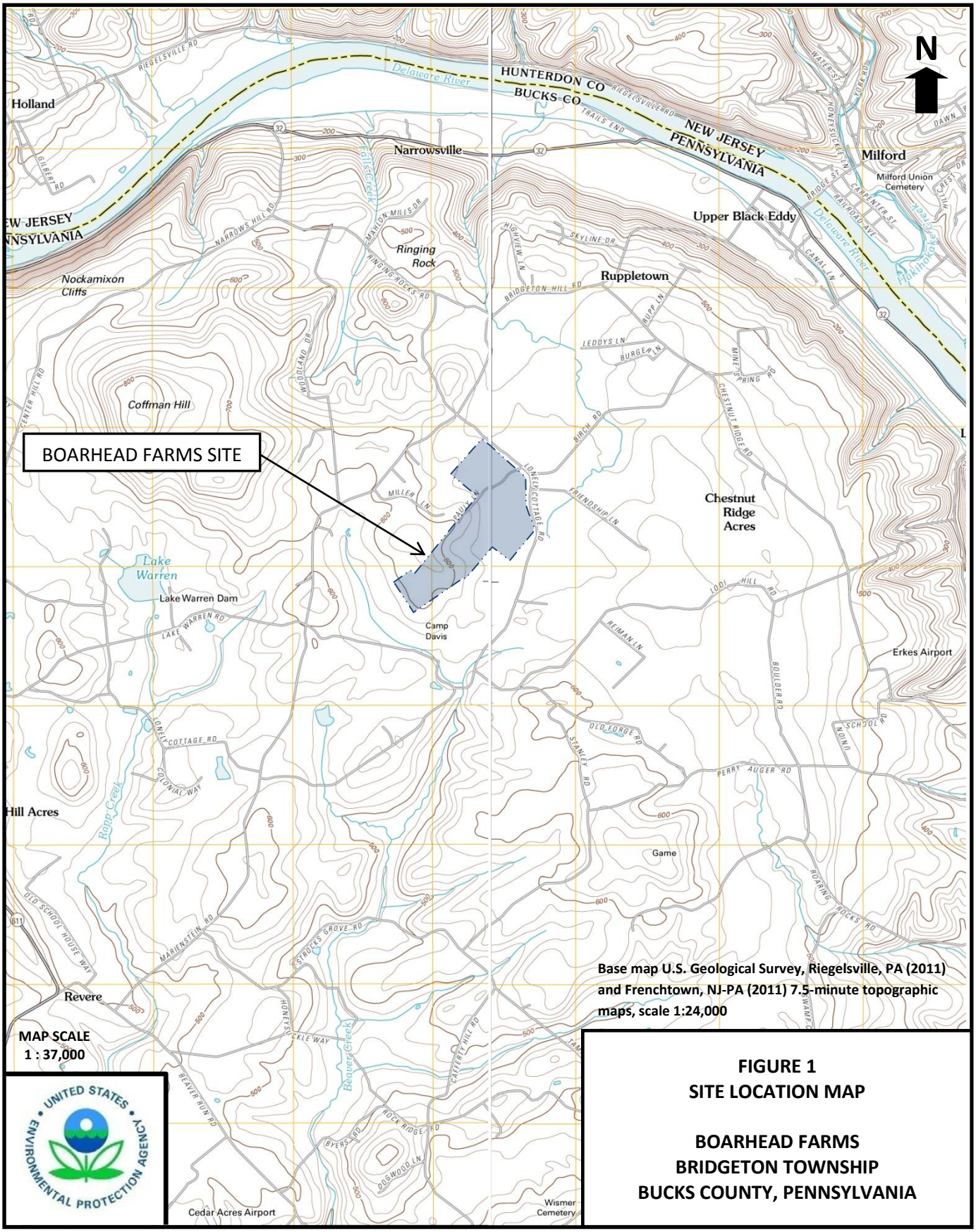


FIGURE 1
SITE LOCATION MAP

BOARHEAD FARMS
BRIDGETON TOWNSHIP
BUCKS COUNTY, PENNSYLVANIA

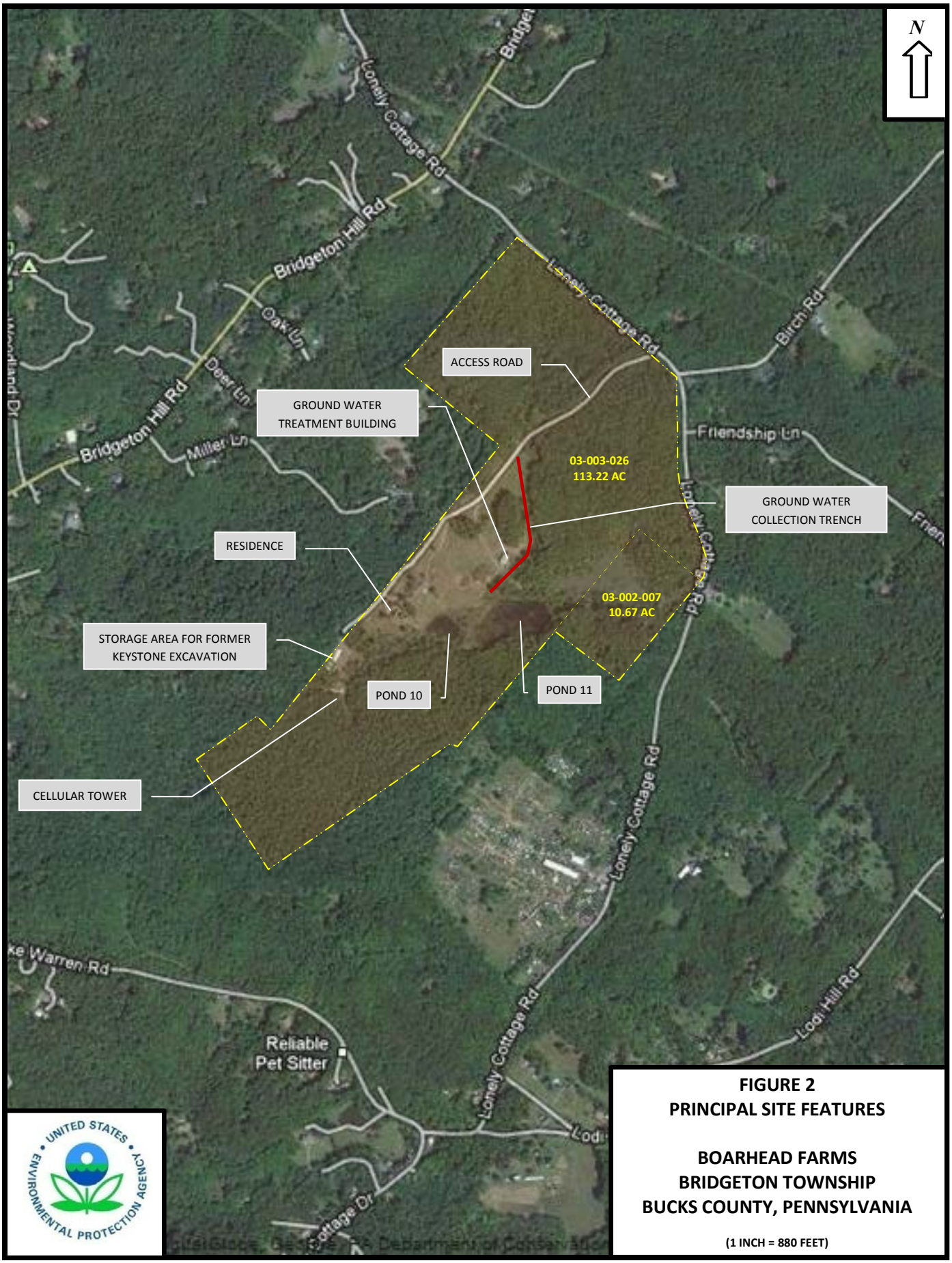
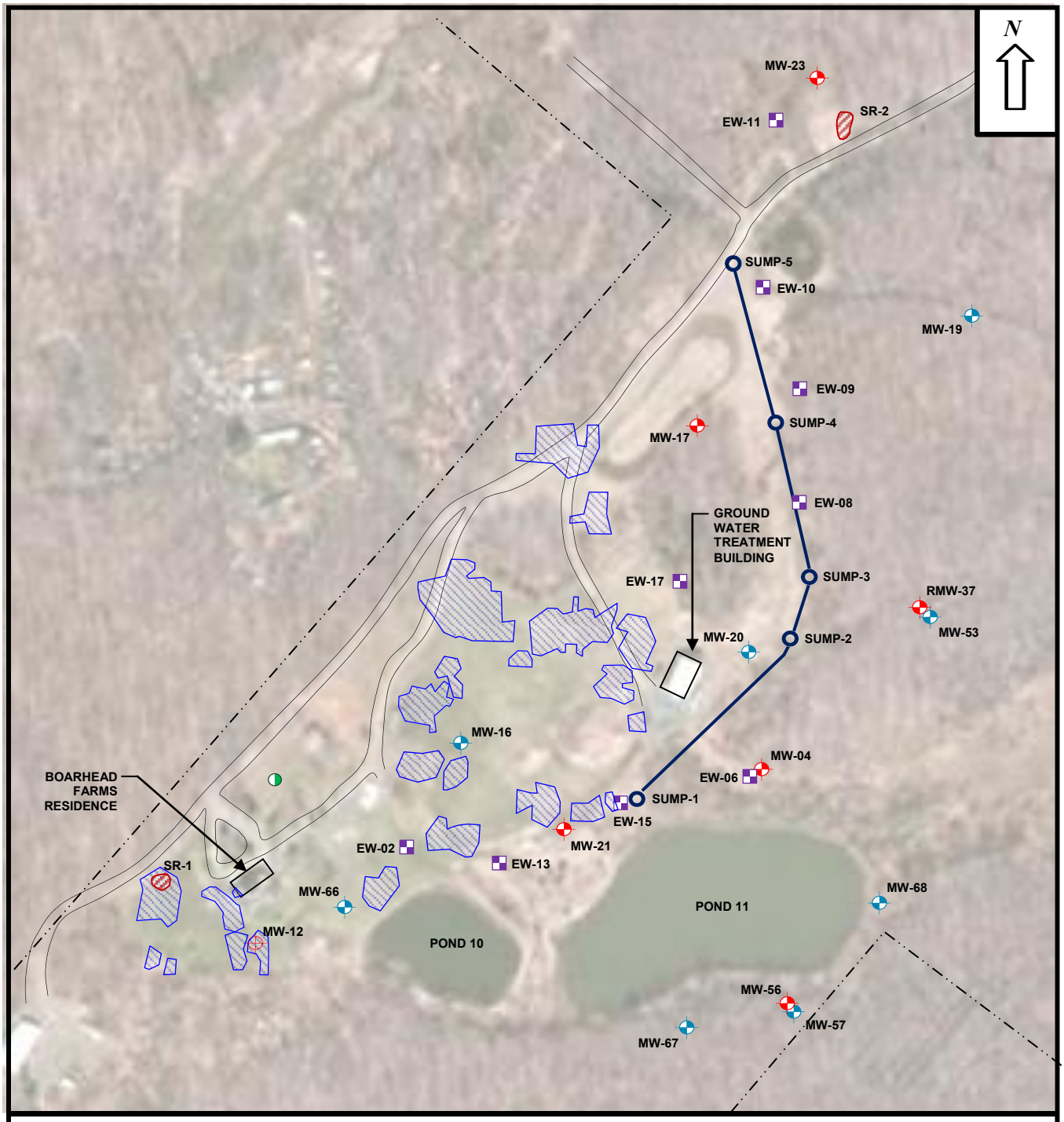


FIGURE 2
PRINCIPAL SITE FEATURES

BOARHEAD FARMS
BRIDGETON TOWNSHIP
BUCKS COUNTY, PENNSYLVANIA

(1 INCH = 880 FEET)



Base map from U.S. Geological Survey Riegelsville, PA-NJ and Frenchtown, PA-NJ 7.5-minute orthophotographs, circa 2011.

Extent of Soil Remedy Areas and magnetic anomalies derived from Brown & Caldwell, *Remedial Construction Report, Operable Unit No. 2, Boarhead Farms Superfund Site, May 2004.* Pre-excavation extents presented. Actual excavated areas varied slightly based on observed conditions, as outlined in the report.

Well, sump, and interceptor trench locations from various Brown & Caldwell reports. Inactive extraction and monitoring wells not presented.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

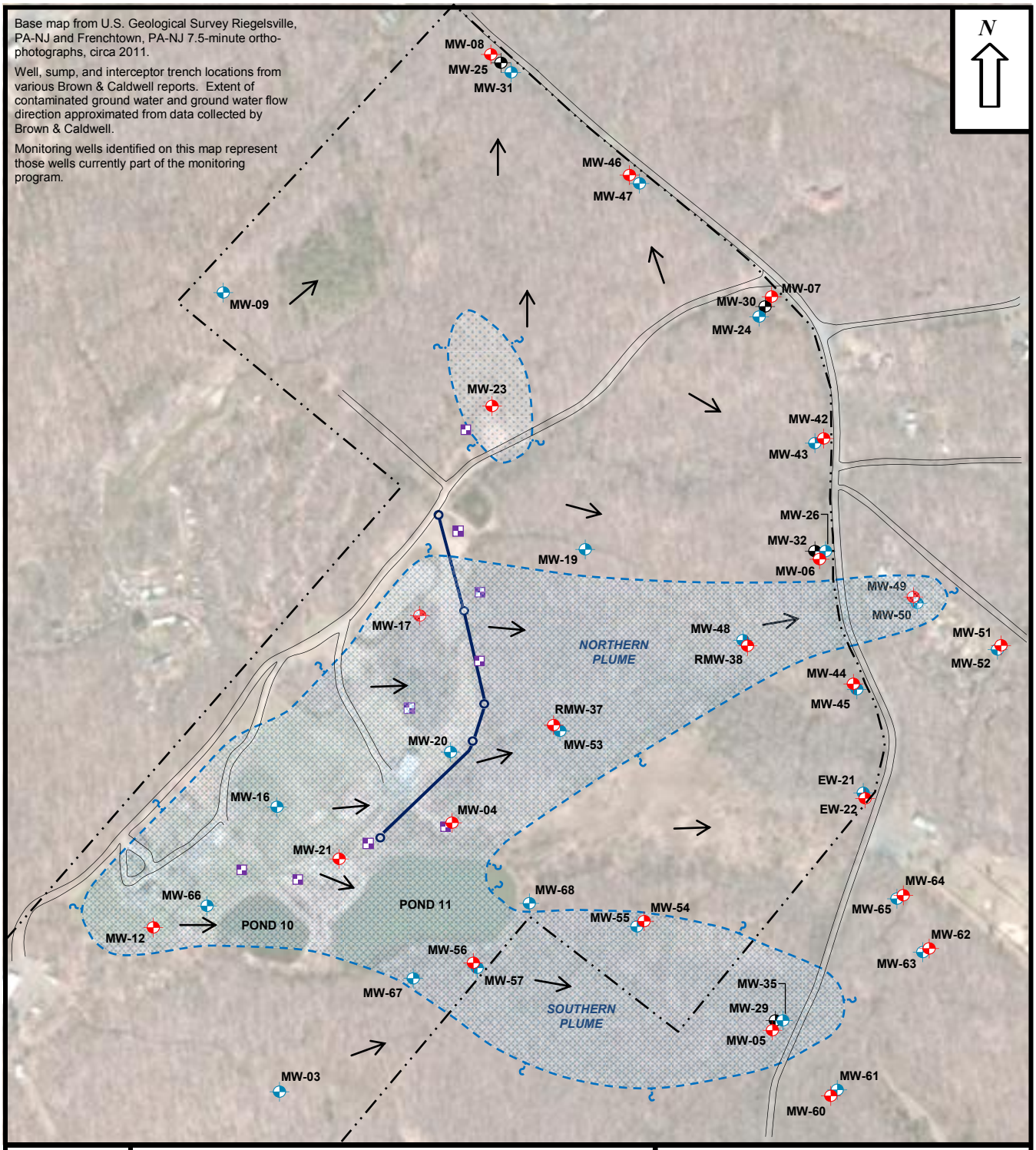
LEGEND

- EXTRACTION WELL (ACTIVE)
- EXTRACTION SUMP
- MONITORING WELL
- POTABLE DRINKING WATER WELL
- INTERCEPTOR TRENCH
- SITE BOUNDARY
- SOIL REMEDY AREA
- MAGNETIC ANAMOLY (SOURCE REMOVED DURING REMEDIAL ACTION)

FIGURE 3
PRINCIPAL REMEDY COMPONENTS AND FORMER SOURCE AREAS

BOARHEAD FARMS
BRIDGETON TOWNSHIP
BUCKS COUNTY, PENNSYLVANIA

(1 INCH = 270 FEET)



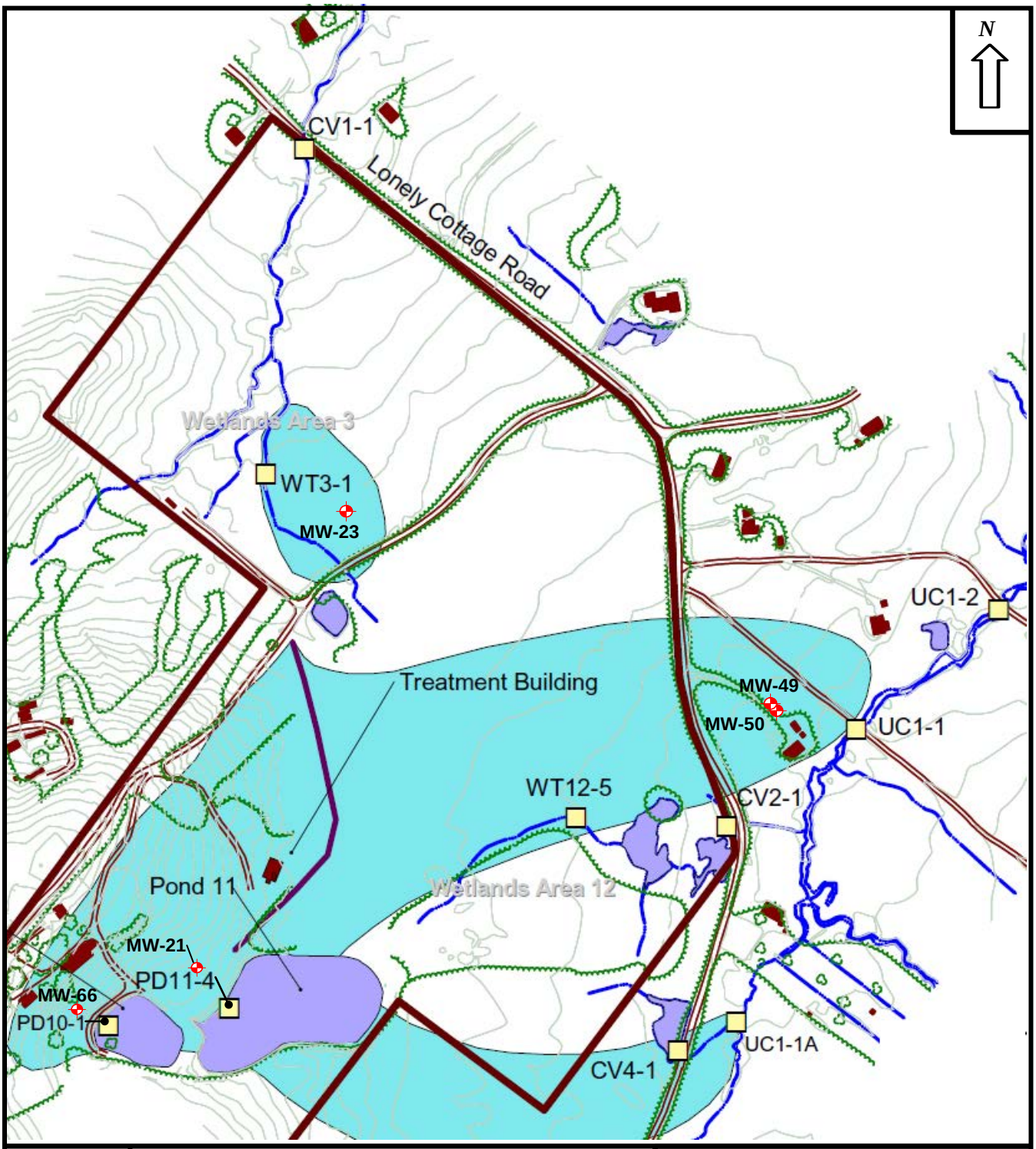
LEGEND

- MONITORING WELL COMPLETED IN OVERBURDEN
- MONITORING WELL COMPLETED IN SAPROLITE OR SHALLOW BEDROCK
- MONITORING WELL COMPLETED IN SAPROLITE OR SHALLOW BEDROCK
- EXTRACTION WELL (ACTIVE)
- EXTRACTION SUMP
- INTERCEPTOR TRENCH (APPROXIMATE)
- SITE BOUNDARY
- KNOWN EXTENT OF CONTAMINATED GROUND WATER (APPROXIMATE), UNCERTAIN WHERE NOTED
- NET DIRECTION OF GROUND WATER FLOW (APPROXIMATE)

FIGURE 4
MONITORING WELL NETWORK AND EXTENT OF CONTAMINATED GROUND WATER

BOARHEAD FARMS
BRIDGETON TOWNSHIP
BUCKS COUNTY, PENNSYLVANIA

(1 INCH = 420 FEET)



LEGEND

- PORE-WATER SAMPLING LOCATION
- MONITORING WELL
- EXTENT OF GROUND WATER CONTAMINATION (APPROXIMATE)
- SITE BOUNDARY

Figure modified from Brown & Caldwell memorandum, "Pore Water Sampling Results," April 14, 2009.

FIGURE 5
SEDIMENT PORE-WATER SAMPLING LOCATIONS

BOARHEAD FARMS
BRIDGETON TOWNSHIP
BUCKS COUNTY, PENNSYLVANIA
(1 INCH = 580 FEET)

Attachment 1

Discharge Monitoring Report

de maximis, inc.

1405 North Cedar Crest Blvd.
Suite 200
Allentown, PA 18104
(610) 435-1151
(610) 435-8459 FAX

March 21, 2012

Via U.S. Mail

Mr. Dustin Armstrong
PADEP
2 East Main Street
Norristown, PA 19401

RE: Boarhead Farms Superfund Site OU-1
EPA Docket No. III-2000-01-DC
4th Quarter 2011 Effluent Discharge Monitoring Report
Groundwater Collection and Treatment System

Dear Mr. Armstrong:

Enclosed please find the completed Discharge Monitoring Report (DMR) forms for the 4th Quarter 2011 effluent samples from the groundwater treatment plant at the Boarhead Farms Site (Site). These DMR forms are being submitted on behalf of the Respondents in the above referenced EPA docket, and other companies contributing to the funding of the OU-1 remedy. The DMRs are submitted based on PADEP's December 29, 2000 revised Permit with the exception of collecting a 24-hour composite sample for inorganic constituents. In a letter dated March 28, 2001, EPA recommended that the sampling frequency be changed to a composite sample over an 8-hour period.

I would like to call to your attention the following, relative to these DMRs for the 4th Quarter 2011:

- This report is being submitted later than anticipated due to a laboratory error reporting the data. Results were reported with a non required dilution factor that forced non detected results being reported as ND but above the permit level.
- VOCs were not detected above permit levels.

Please contact Geoff Seibel or me with any questions at (610) 435-1151.

Sincerely,

de maximis, inc.

R. Craig Coslett
Assistant Project Coordinator for OU 1

Enclosures: DMR Forms for 4th Quarter 2011
CC: Chris Sklaney, USEPA
Boarhead Farms OU1 Performing Parties
Peter Randazzo, Brown and Caldwell
D. Bigler, Bigler Associates

File: 4087 /dmr 4th DMR 2011

ADDRESS: 1[illegible] SOUTH CEDAR CREST BOULEVARD	XXXX				001		
SUITE 202	PERMIT NUMBER				DISCHARGE NUMBER		
ALLENTOWN, PA 18103	MONITORING PERIOD						
FAC. ADDRESS: WASTEWATER TREATMENT PLANT	YEAR	MO	DAY	TO	YEAR	MO	DAY
MUNICIPALITY: BRIDGETON TOWNSHIP	2011	10	01		2011	12	31
COUNTY: BUCKS							

OMB NO. 2[illegible]. 1004.
Southeast Region Facsimile

6/18/01

NOTE: Read Instructions before completing this form

Parameter		QUANTITY OR LOADING			QUALITY OR CONCENTRATION				NO. EX	FREQUENCY OF ANALYSIS	SAMPLE TYPE
		MONTHLY AVERAGE	DAILY MAXIMUM	UNITS	MINIMUM	MONTHLY AVERAGE	DAILY MAXIMUM	UNITS			
FLOW	Sample Measurement	16525	28704		XXXX	XXXX	XXXX		0	CONT.	REC
	Permit Requirement	MONITOR	MONITOR	GPD	XXXX	XXXX	XXXX	XXXX		CONT.	REC
ANTIMONY	Sample Measurement	XXXX	XXXX		XXXX	<0.0084	<0.0084		0	1/QUART	*
	Permit Requirement	XXXX	XXXX	XXXX	XXXX	0.015	0.031	MG/L		1/MONTH	*
ARSENIC	Sample Measurement	XXXX	XXXX		XXXX	<0.0042	<0.0042		0	1/QUART	*
	Permit Requirement	XXXX	XXXX	XXXX	XXXX	MONITOR/ REPORT	MONITOR/ REPORT	MG/L		QUARTERLY	*
CADMIUM	Sample Measurement	XXXX	XXXX		XXXX	<0.0009	<0.0009		0	1/QUART	*
	Permit Requirement	XXXX	XXXX	XXXX	XXXX	0.0042	0.0084	MG/L		1/MONTH	*
CHROMIUM, HEXAVALENT	Sample Measurement	XXXX	XXXX		XXXX	<0.0027	<0.0027		0	1/QUART	*
	Permit Requirement	XXXX	XXXX	XXXX	XXXX	0.011	0.023	MG/L		1/MONTH	*
COPPER	Sample Measurement	XXXX	XXXX		XXXX	<0.0089	<0.0089		0	1/QUART	*
	Permit Requirement	XXXX	XXXX	XXXX	XXXX	0.016	0.033	MG/L		1/MONTH	*
LEAD	Sample Measurement	XXXX	XXXX		XXXX	0.0034	0.0034		0	1/QUART	*
	Permit Requirement	XXXX	XXXX	XXXX	XXXX	0.007	0.014	MG/L		1/MONTH	*

NAME/TITLE PRINCIPAL EXECUTIVE OFFICER	I CERTIFY UNDER PENALTY OF LAW THAT I HAVE PERSONALLY EXAMINED AND AM FAMILIAR WITH THE INFORMATION SUBMITTED HEREIN AND BASED ON MY INQUIRY OF THOSE INDIVIDUALS IMMEDIATELY RESPONSIBLE FOR OBTAINING THE INFORMATION, I BELIEVE THE SUBMITTED INFORMATION IS TRUE, ACCURATE AND COMPLETE. I AM AWARE THAT THERE ARE SIGNIFICANT PENALTIES FOR SUBMITTING FALSE INFORMATION, INCLUDING THE POSSIBILITY OF FINE AND IMPRISONMENT SEE 18 U.S.C. §1001 AND 33 U.S.C. §1319. (Penalties under these statutes may include fines up to $10,000 and or maximum imprisonment of between 6 months and 5 years)		TELEPHONE		DATE		
TYPE OR PRINT		SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	AREA CODE	NUMBER	YEAR	MO	DAY

COMMENT AND EXPLANATION OF ANY VIOLATIONS (Reference all attachments here)

PERMIT EXPIRES _____ . SUBMIT RENEWAL BY _____ .

* See Other Requirement No. 9 on page No. 15 of Permit (2/4 hour cycles).

ADDRESS: 1 SOUTH CEDAR CREST BOULEVARD	XXXX		001
ST. 202	PERMIT NUMBER		DISCHARGE NUMBER
ALLENTOWN, PA 18103	MONITORING PERIOD		
FAC ADDRESS: WASTEWATER TREATMENT PLANT	YEAR: 2011	MO: 10	DAY: 01 TO YEAR: 2011 MO: 12 DAY: 31
MUNICIPALITY: BRIDGETON TOWNSHIP			
COUNTY: BUCKS			

FORM 3320-1
OMB NO. 2040-0004
Southeast Region Facsimile

NOTE: Read instructions before completing this form

Parameter		QUANTITY OR LOADING MONTHLY AVERAGE	QUANTITY OR LOADING DAILY MAXIMUM	UNITS	QUALITY OR CONCENTRATION MINIMUM	QUALITY OR CONCENTRATION MONTHLY AVERAGE	QUALITY OR CONCENTRATION DAILY MAXIMUM	UNITS	NO. EX	FREQUENCY OF ANALYSIS	SAMPLE TYPE
NICKEL	Sample Measurement	XXXX	XXXX		XXXX	0.0051	0.0051		0	1/QUART	*
	Permit Requirement	XXXX	XXXX	XXXX	XXXX	0.09	0.18	MGL		1/MONTH	*
ZINC	Sample Measurement	XXXX	XXXX		XXXX	<0.0053	<0.0053		0	1/QUART	*
	Permit Requirement	XXXX	XXXX	XXXX	XXXX	0.157	0.315	MGL		1/MONTH	*
MANGENESE	Sample Measurement	XXXX	XXXX		XXXX	0.0375	0.0375		0	1/QUART	*
	Permit Requirement	XXXX	XXXX	XXXX	XXXX	1.12	2.24	MGL		1/MONTH	*
ALUMINUM	Sample Measurement	XXXX	XXXX		XXXX	<0.0683	<0.0683		0	1/QUART	*
	Permit Requirement	XXXX	XXXX	XXXX	XXXX	0.623	1.25	MGL		1/MONTH	*
COBALT	Sample Measurement	XXXX	XXXX		XXXX	<0.0048	<0.0048		0	1/QUART	*
	Permit Requirement	XXXX	XXXX	XXXX	XXXX	0.021	0.043	MGL		1/MONTH	*
IRON, TOTAL	Sample Measurement	XXXX	XXXX		XXXX	<0.0809	<0.0809		0	1/QUART	*
	Permit Requirement	XXXX	XXXX	XXXX	XXXX	1.68	3.36	MGL		1/MONTH	*
MERCURY	Sample Measurement	XXXX	XXXX		XXXX	<0.00016	<0.00016		0	1/QUART	*
	Permit Requirement	XXXX	XXXX	XXXX	XXXX	ND	ND	MGL		1/MONTH	*

NAME/TITLE PRINCIPAL EXECUTIVE OFFICER	I CERTIFY UNDER PENALTY OF LAW THAT I HAVE PERSONALLY EXAMINED AND AM FAMILIAR WITH THE INFORMATION SUBMITTED HEREIN AND BASED ON MY INQUIRY OF THOSE INDIVIDUALS IMMEDIATELY RESPONSIBLE FOR OBTAINING THE INFORMATION, I BELIEVE THE SUBMITTED INFORMATION IS TRUE, ACCURATE AND COMPLETE. I AM AWARE THAT THERE ARE SIGNIFICANT PENALTIES FOR SUBMITTING FALSE INFORMATION, INCLUDING THE POSSIBILITY OF FINE AND IMPRISONMENT SEE 18 U.S.C. §1001 AND 33 U.S.C. §1319. (Penalties under these statutes may include fines up to $10,000 and or maximum imprisonment of between 6 months and 5 years)		TELEPHONE	DATE
TYPE OR PRINT	SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	AREA CODE NUMBER	YEAR	MO DAY

COMMENT AND EXPLANATION OF ANY VIOLATIONS (Reference all attachments here) PERMIT EXPIRES _____ SUBMIT RENEWAL BY _____

* See Other Requirement No. 9 on page No. 15 of Permit (2/M hour cycles).

ADDRESS: 3 SOUTH CEDAR CREST BOULEVARD	XXXX				001		
SUITE 202	PERMIT NUMBER				DISCHARGE NUMBER		
ALLENTOWN, PA 18103	MONITORING PERIOD						
FAC. ADDRESS: WASTEWATER TREATMENT PLANT	YEAR	MO	DAY	TO	YEAR	MO	DAY
MUNICIPALITY: BRIDGETON TOWNSHIP	2011	10	01		2011	12	31
COUNTY: BUCKS							

OMB NO. 20 .004
Southeast Region Facsimile

NOTE: Read instructions before completing this form.

Parameter		QUANTITY OR LOADING			QUALITY OR CONCENTRATION				NO. EX	FREQUENCY OF ANALYSIS	SAMPLE TYPE
		MONTHLY AVERAGE	DAILY MAXIMUM	UNITS	MONTHLY MINIMUM	MONTHLY AVERAGE	DAILY MAXIMUM	UNITS			
SILVER	Sample Measurement	XXXX	XXXX		XXXX	<0.00069	<0.00069		0	1/QUART	*
	Permit Requirement	XXXX	XXXX	XXXX	XXXX	0.008	0.017	MG/L		1/MONTH	*
CYANIDE, FREE	Sample Measurement	XXXX	XXXX		XXXX	<0.0014	<0.0014		0	1/QUART	*
	Permit Requirement	XXXX	XXXX	XXXX	XXXX	0.005	0.011	MG/L		1/MONTH	*
2,4,6-TRICHLOROPHENOL	Sample Measurement	XXXX	XXXX		XXXX	<0.0025	<0.0025		0	1/QUART	GRAB
	Permit Requirement	XXXX	XXXX	XXXX	XXXX	0.0038	0.0076	MG/L		1/MONTH	GRAB
BENZENE	Sample Measurement	XXXX	XXXX		XXXX	<0.00015	<0.00015		0	1/QUART	GRAB
	Permit Requirement	XXXX	XXXX	XXXX	XXXX	0.0022	0.004	MG/L		1/MONTH	GRAB
	Sample Measurement										
	Permit Requirement										
	Sample Measurement										
	Permit Requirement										
	Sample Measurement										
	Permit Requirement										

NAME/TITLE PRINCIPAL EXECUTIVE OFFICER	I CERTIFY UNDER PENALTY OF LAW THAT I HAVE PERSONALLY EXAMINED AND AM FAMILIAR WITH THE INFORMATION SUBMITTED HEREIN AND BASED ON MY INQUIRY OF THOSE INDIVIDUALS IMMEDIATELY RESPONSIBLE FOR OBTAINING THE INFORMATION, I BELIEVE THE SUBMITTED INFORMATION IS TRUE, ACCURATE AND COMPLETE. I AM AWARE THAT THERE ARE SIGNIFICANT PENALTIES FOR SUBMITTING FALSE INFORMATION, INCLUDING THE POSSIBILITY OF FINE AND IMPRISONMENT SEE 18 U.S.C. §1001 AND 33 U.S.C. §1319. (Penalties under these statutes may include fines up to $10,000 and or maximum imprisonment of between 6 months and 5 years)		TELEPHONE		DATE		
TYPE OR PRINT		SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	AREA CODE	NUMBER	YEAR	MO	DAY

COMMENT AND EXPLANATION OF ANY VIOLATIONS (Reference all attachments here)

PERMIT EXPIRES _____ . SUBMIT RENEWAL BY _____

* See Other Requirement No. 9 on page No. 15 of Permit (2/4 hour cycles).

ADDRESS: 7	25 SOUTH CEDAR CREST BOULEVARD	XXXX				001		
SUITE 202		PERMIT NUMBER				DISCHARGE NUMBER		
ALLENTOWN, PA 18103		MONITORING PERIOD						
FAC ADDRESS:	WASTEWATER TREATMENT PLANT	YEAR	MO	DAY	TO	YEAR	MO	DAY
MUNICIPALITY:	BRIDGETON TOWNSHIP	2011	10	01		2011	12	31
COUNTY:	BUCKS							

OMB NO. 20-[illegible]-0004
Southeast Region Facsimile

NOTE: Read Instructions before completing this form

Parameter		QUANTITY OR LOADING			QUALITY OR CONCENTRATION				NO. EX	FREQUENCY OF ANALYSIS	SAMPLE TYPE
		MONTHLY AVERAGE	DAILY MAXIMUM	UNITS	MONTHLY MINIMUM	MONTHLY AVERAGE	DAILY MAXIMUM	UNITS			
1,2-DICHLOROETHANE	Sample Measurement	XXXX	XXXX		XXXX	<0.00016	<0.00016		0	1/QUART	GRAB
	Permit Requirement	XXXX	XXXX	XXXX	XXXX	0.0007	0.0014	MG/L		1/MONTH	GRAB
1,1-DICHLOROETHYLENE	Sample Measurement	XXXX	XXXX		XXXX	<0.00017	<0.00017		0	1/QUART	GRAB
	Permit Requirement	XXXX	XXXX	XXXX	XXXX	ND	0.0002	MG/L		1/MONTH	GRAB
METHYLENE CHLORIDE	Sample Measurement	XXXX	XXXX		XXXX	<0.00016	<0.00016		0	1/QUART	GRAB
	Permit Requirement	XXXX	XXXX	XXXX	XXXX	0.0086	0.017	MG/L		1/MONTH	GRAB
TETRACHLOROETHYLENE	Sample Measurement	XXXX	XXXX		XXXX	<0.00015	<0.00015		0	1/QUART	GRAB
	Permit Requirement	XXXX	XXXX	XXXX	XXXX	0.0015	0.003	MG/L		1/MONTH	GRAB
TOLUENE	Sample Measurement	XXXX	XXXX		XXXX	<0.00016	<0.00016		0	1/QUART	GRAB
	Permit Requirement	XXXX	XXXX	XXXX	XXXX	0.0023	0.0046	MG/L		1/MONTH	GRAB
1,1,1-TRICHLOROETHANE	Sample Measurement	XXXX	XXXX		XXXX	<0.00017	<0.00017		0	1/QUART	GRAB
	Permit Requirement	XXXX	XXXX	XXXX	XXXX	0.017	0.034	MG/L		1/MONTH	GRAB
TRICHLOROETHYLENE	Sample Measurement	XXXX	XXXX		XXXX	0.00068	0.00068		0	1/QUART	GRAB
	Permit Requirement	XXXX	XXXX	XXXX	XXXX	0.005	0.01	MG/L		1/MONTH	GRAB

NAME/TITLE PRINCIPAL EXECUTIVE OFFICER	I CERTIFY UNDER PENALTY OF LAW THAT I HAVE PERSONALLY EXAMINED AND AM FAMILIAR WITH THE INFORMATION SUBMITTED HEREIN AND BASED ON MY INQUIRY OF THOSE INDIVIDUALS IMMEDIATELY RESPONSIBLE FOR OBTAINING THE INFORMATION, I BELIEVE THE SUBMITTED INFORMATION IS TRUE, ACCURATE AND COMPLETE. I AM AWARE THAT THERE ARE SIGNIFICANT PENALTIES FOR SUBMITTING FALSE INFORMATION, INCLUDING THE POSSIBILITY OF FINE AND IMPRISONMENT SEE 18 U.S.C. §1001 AND 33 U.S.C. §1319. (Penalties under these statutes may include fines up to $10,000 and or maximum imprisonment of between 6 months and 5 years)		TELEPHONE		DATE		
TYPE OR PRINT		SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	AREA CODE	NUMBER	YEAR	MO	DAY

COMMENT AND EXPLANATION OF ANY VIOLATIONS (Reference all attachments here)

PERMIT EXPIRES _____ . SUBMIT RENEWAL BY _____ .

FORM APPROVED
OMB NO. 2040-0004
Southeast Region Facsimile

ADDRESS: 5 SOUTH CEDAR CREST BOULEVARD	XXXX				001		
SUITE 202	PERMIT NUMBER				DISCHARGE NUMBER		
ALLENTOWN, PA 18103	MONITORING PERIOD						
FAC. ADDRESS: WASTEWATER TREATMENT PLANT	YEAR	MO	DAY	TO	YEAR	MO	DAY
MUNICIPALITY: BRIDGETON TOWNSHIP	2011	10	01		2011	12	31
COUNTY: BUCKS							

NOTE: Read Instructions before completing this form

Parameter		QUANTITY OR LOADING MONTHLY AVERAGE	QUANTITY OR LOADING DAILY MAXIMUM	UNITS	QUALITY OR CONCENTRATION MINIMUM	QUALITY OR CONCENTRATION MONTHLY AVERAGE	QUALITY OR CONCENTRATION DAILY MAXIMUM	UNITS	NO. EX	FREQUENCY OF ANALYSIS	SAMPLE TYPE
VINYL CHLORIDE	Sample Measurement	XXXX	XXXX		XXXX	<0.00011	<0.00011		0	1/QUART	GRAB
	Permit Requirement	XXXX	XXXX	XXXX	XXXX	0.0036	0.0072	MG/L		1/MONTH	GRAB
ACETONE	Sample Measurement	XXXX	XXXX		XXXX	0.063	0.063		0	QUARTERLY	GRAB
	Permit Requirement	XXXX	XXXX	XXXX	XXXX	MONITOR/ REPORT	MONITOR/ REPORT	MG/L		QUARTERLY	GRAB
XYLENES, TOTAL	Sample Measurement	XXXX	XXXX		XXXX	<0.00048	<0.00048		0	QUARTERLY	GRAB
	Permit Requirement	XXXX	XXXX	XXXX	XXXX	MONITOR/ REPORT	MONITOR/ REPORT	MG/L		QUARTERLY	GRAB
1,2-DICHLOROBENZENE	Sample Measurement	XXXX	XXXX		XXXX	<0.00013	<0.00013		0	QUARTERLY	GRAB
	Permit Requirement	XXXX	XXXX	XXXX	XXXX	MONITOR/ REPORT	MONITOR/ REPORT	MG/L		QUARTERLY	GRAB
NAPTHALENE	Sample Measurement	XXXX	XXXX		XXXX	<0.00015	<0.00015		0	QUARTERLY	GRAB
	Permit Requirement	XXXX	XXXX	XXXX	XXXX	MONITOR/ REPORT	MONITOR/ REPORT	MG/L		QUARTERLY	GRAB
CHROMIUM, TRIVALENT	Sample Measurement				XXXX	<0.0027	<0.0027		0	QUARTERLY	*
	Permit Requirement				XXXX	MONITOR/ REPORT	MONITOR/ REPORT	MG/L		QUARTERLY	*
	Sample Measurement										
	Permit Requirement										

NAME/TITLE PRINCIPAL EXECUTIVE OFFICER	I CERTIFY UNDER PENALTY OF LAW THAT I HAVE PERSONALLY EXAMINED AND AM FAMILIAR WITH THE INFORMATION SUBMITTED HEREIN AND BASED ON MY INQUIRY OF THOSE INDIVIDUALS IMMEDIATELY RESPONSIBLE FOR OBTAINING THE INFORMATION, I BELIEVE THE SUBMITTED INFORMATION IS TRUE, ACCURATE AND COMPLETE. I AM AWARE THAT THERE ARE SIGNIFICANT PENALTIES FOR SUBMITTING FALSE INFORMATION, INCLUDING THE POSSIBILITY OF FINE AND IMPRISONMENT. SEE 18 U.S.C. §1001 AND 33 U.S.C. §1319. (Penalties under these statutes may include fines up to $10,000 and or maximum imprisonment of between 6 months and 5 years)		TELEPHONE		DATE		
TYPE OR PRINT		SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	AREA CODE	NUMBER	YEAR	MO	DAY

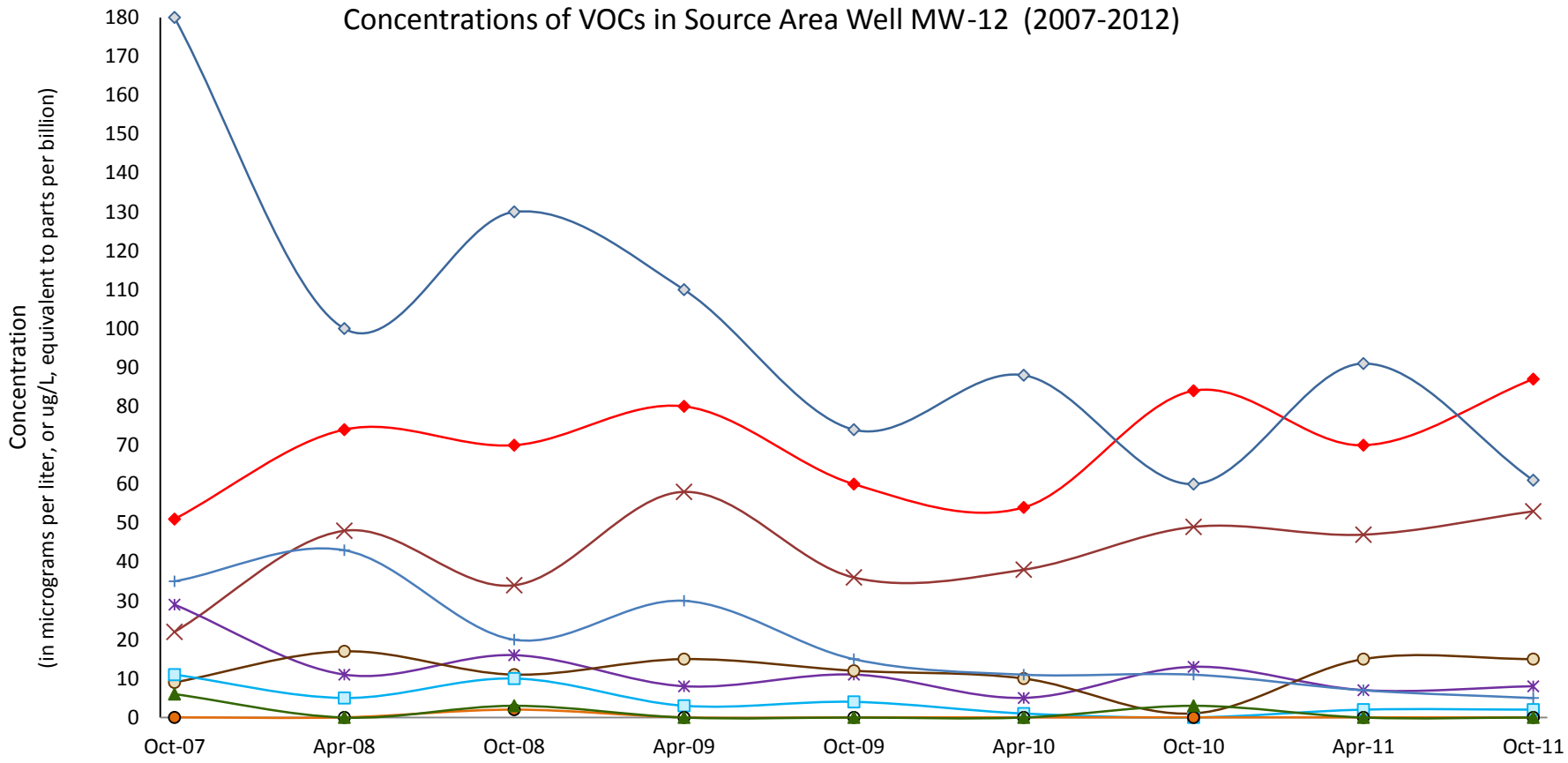
COMMENT AND EXPLANATION OF ANY VIOLATIONS (Reference all attachments here)

PERMIT EXPIRES _____ SUBMIT RENEWAL BY _____

* See Other Requirement No. 9 on page No. 15 of Permit (2/4 hour cycles).

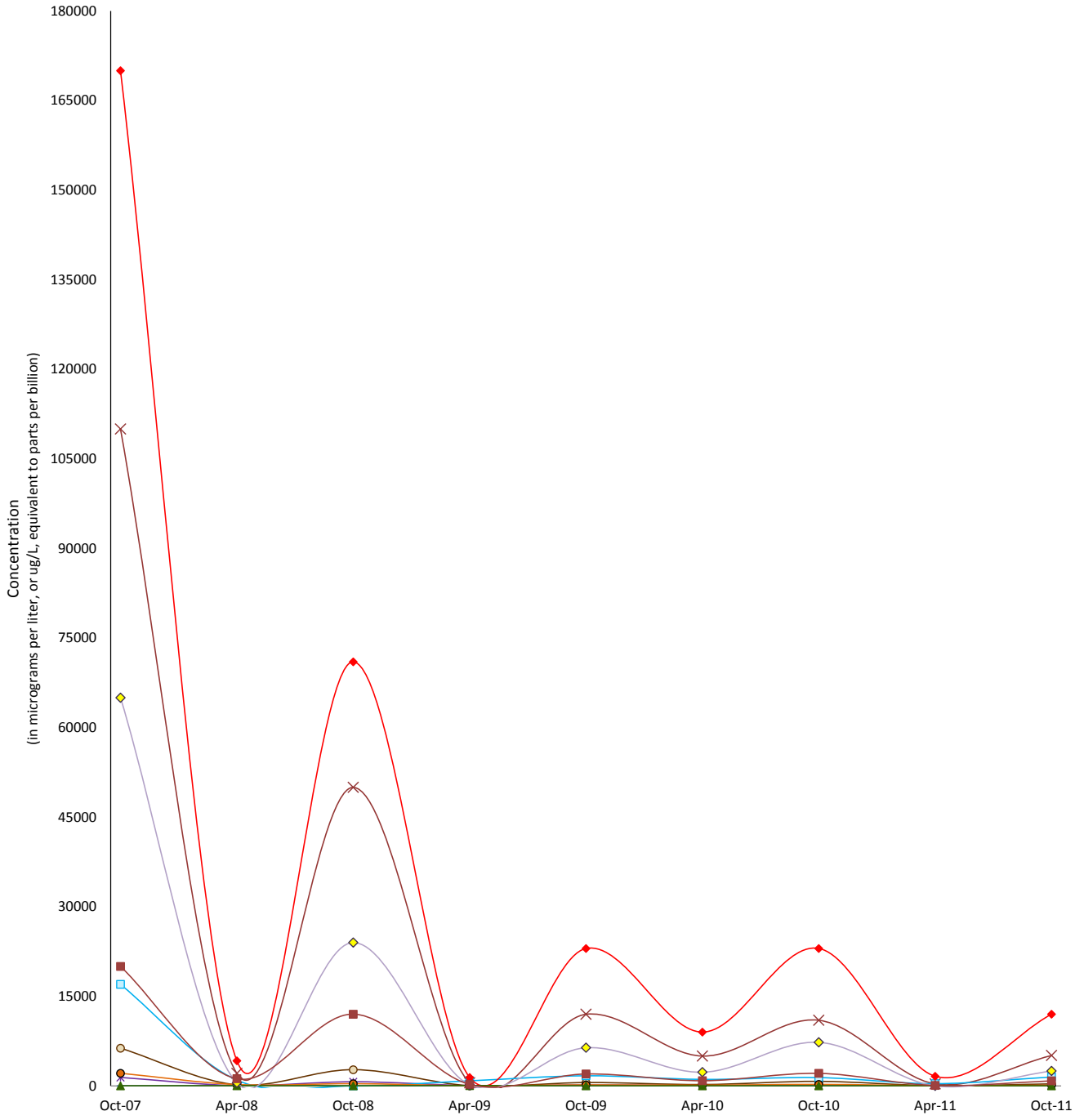
Attachment 2

Concentrations of Volatile Organic Compounds and 1,4-Dioxane in Source Area Monitoring Wells MW-12, MW-16, MW-20, and MW-21



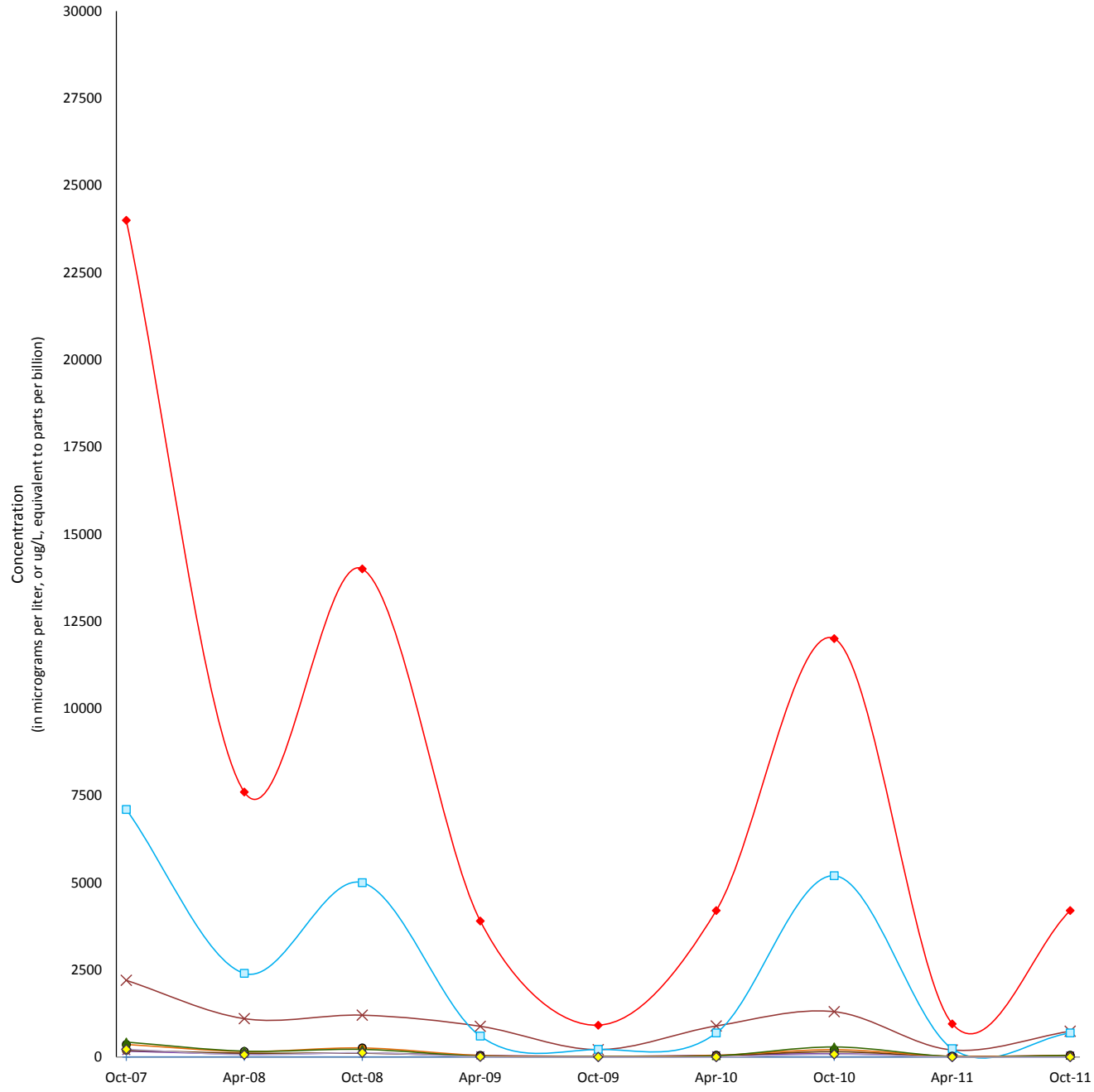
	Oct-07	Apr-08	Oct-08	Apr-09	Oct-09	Apr-10	Oct-10	Apr-11	Oct-11
1,1,1-TCA	22	48	34	58	36	38	49	47	53
1,1-DCA	29	11	16	8	11	5	13	7	8
1,1-DCE	9	17	11	15	12	10	1	15	15
Benzene	35	43	20	30	15	11	11	7	5
cis-1,2-DCE	11	5	10	3	4	1	0	2	2
PCE	0	0	2	0	0	0	0	0	0
TCE	51	74	70	80	60	54	84	70	87
VC	6	0	3	0	0	0	3	0	0
1,4-Dioxane	180	100	130	110	74	88	60	91	61

Concentrations of VOCs in Source Area Well MW-16 (2007-2012)



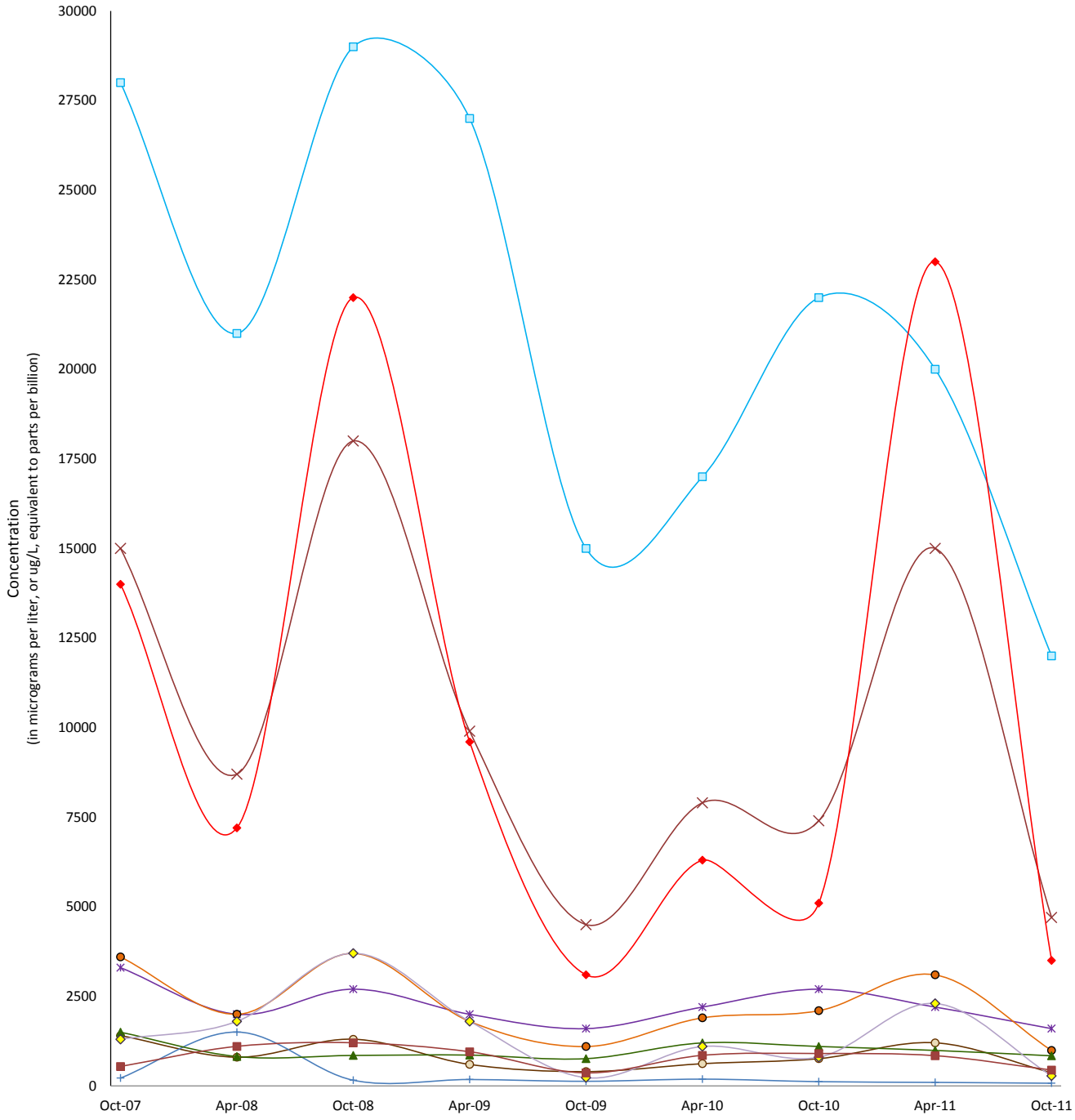
	Oct-07	Apr-08	Oct-08	Apr-09	Oct-09	Apr-10	Oct-10	Apr-11	Oct-11
1,1,1-TCA	110000	2100	50000	520	12000	5000	11000	340	5100
1,1-DCA	1400	46	680	57	150	85	110	28	110
1,1-DCE	6300	160	2700	12	540	210	740	15	320
Benzene	0	0	0	0	0	0	0	0	0
cis-1,2-DCE	17000	980	0	860	1700	1100	1400	380	1500
PCE	2100	210	360	24	160	110	240	32	110
TCE	170000	4200	71000	1400	23000	9000	23000	1600	12000
VC	0	16	0	41	0	0	0	10	0
Toluene	65000	520	24000	170	6400	2300	7300	13	2500
Xylene	20000	1200	12000	250	2000	870	2100	73	850

Concentrations of VOCs in Source Area Well MW-20 (2007-2012)

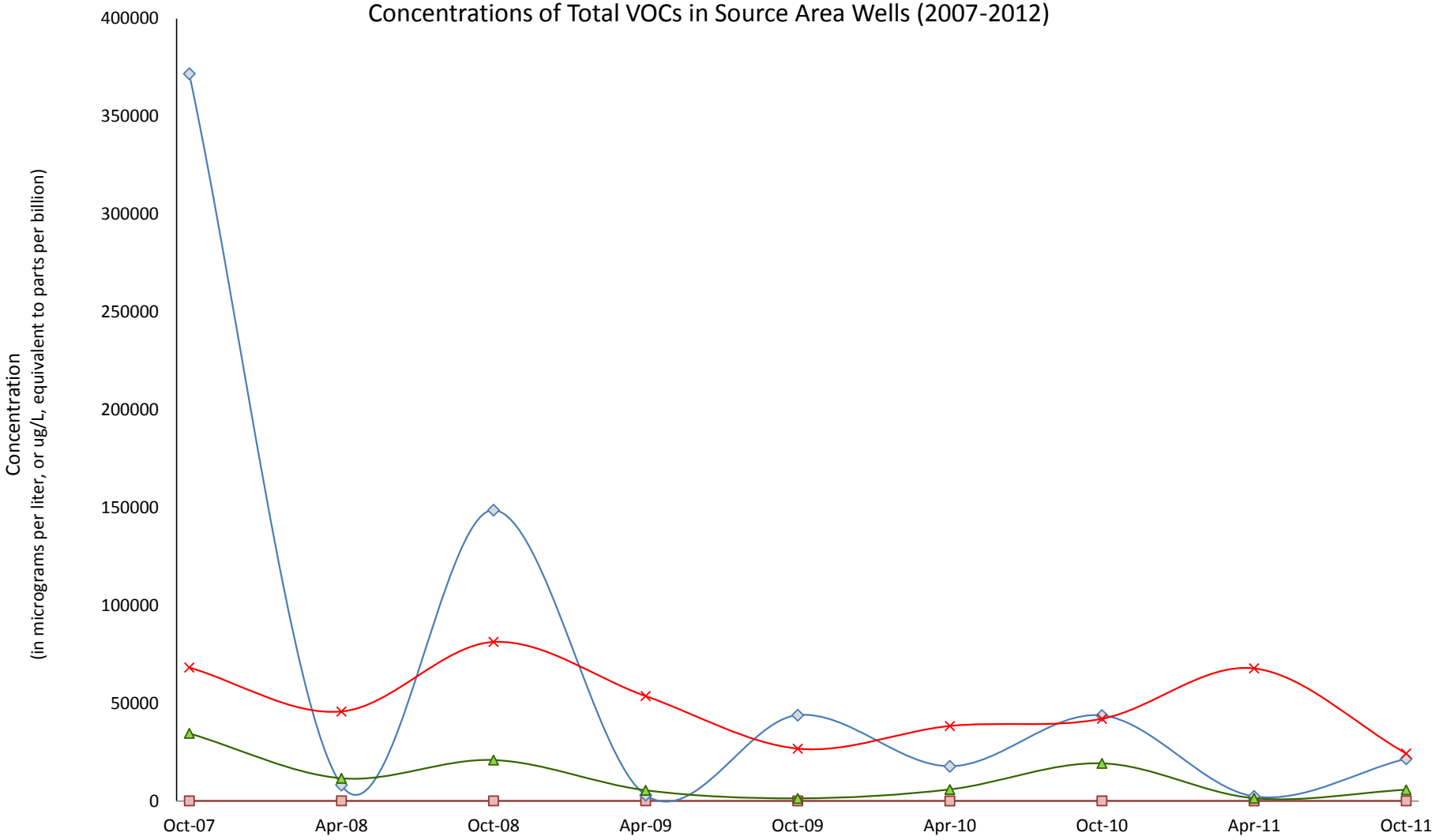


	Oct-07	Apr-08	Oct-08	Apr-09	Oct-09	Apr-10	Oct-10	Apr-11	Oct-11
1,1,1-TCA	2200	1100	1200	880	210	890	1300	200	740
1,1-DCA	170	84	110	45	15	48	93	16	41
1,1-DCE	190	110	110	34	12	41	150	17	35
Benzene	0	0	0	0	0	0	0	0	0
cis-1,2-DCE	7100	2400	5000	600	220	690	5200	240	690
PCE	360	160	260	46	12	50	210	22	52
TCE	24000	7600	14000	3900	910	4200	12000	950	4200
VC	430	170	220	25	11	37	290	14	48
Toluene	220	65	120	8	0	0	78	0	0

Concentrations of VOCs in Source Area Well MW-21 (2007-2012)



	Oct-07	Apr-08	Oct-08	Apr-09	Oct-09	Apr-10	Oct-10	Apr-11	Oct-11
1,1,1-TCA	15000	8700	18000	9900	4500	7900	7400	15000	4700
1,1-DCA	3300	2000	2700	2000	1600	2200	2700	2200	1600
1,1-DCE	1400	800	1300	600	400	620	760	1200	370
Benzene	220	1500	160	180	130	190	120	100	76
cis-1,2-DCE	28000	21000	29000	27000	15000	17000	22000	20000	12000
PCE	3600	2000	3700	1800	1100	1900	2100	3100	990
TCE	14000	7200	22000	9600	3100	6300	5100	23000	3500
VC	1500	820	850	860	760	1200	1100	990	840
Toluene	1300	1800	3700	1800	230	1100	800	2300	280
Xylene	540	1100	1200	950	360	850	900	840	440

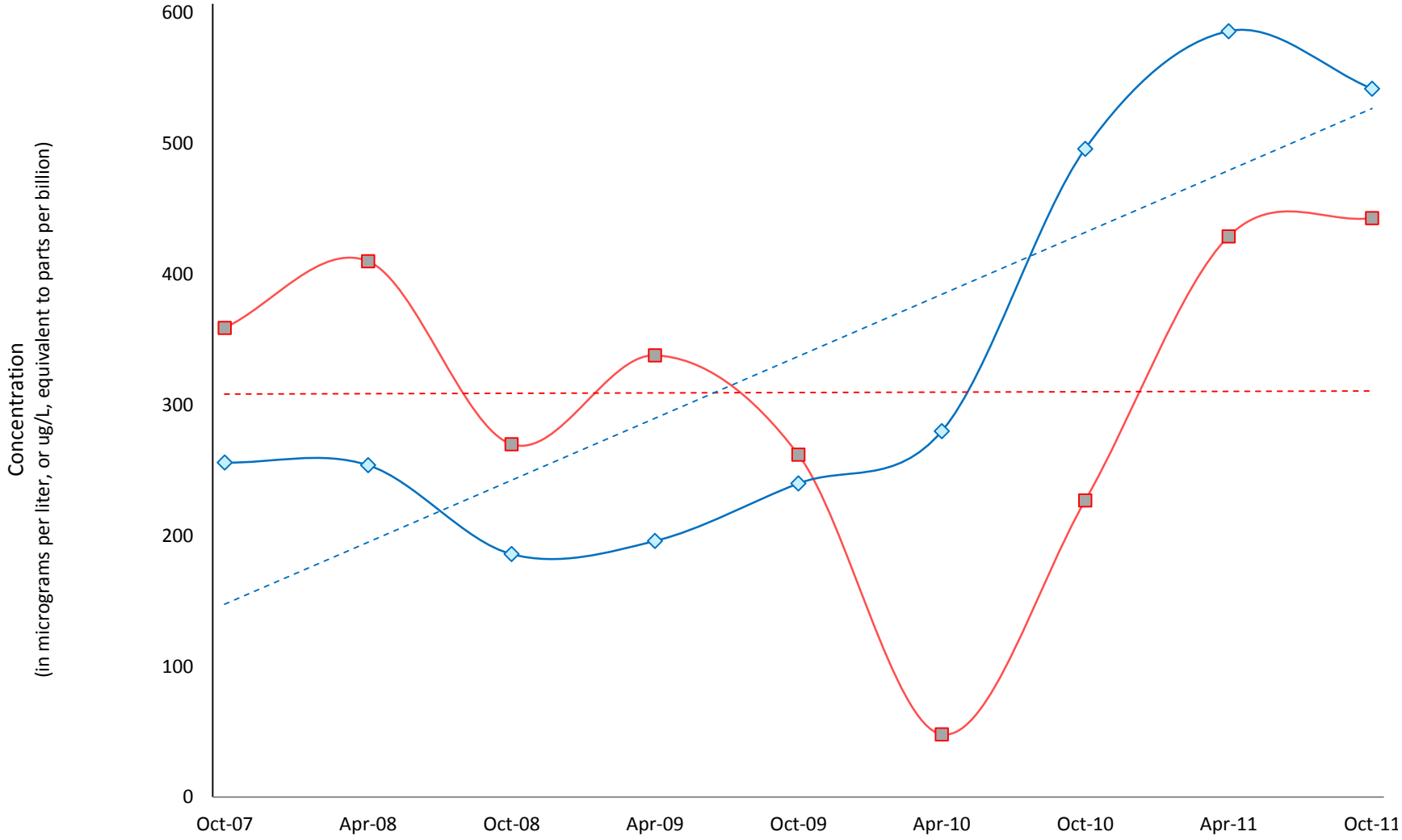


	Oct-07	Apr-08	Oct-08	Apr-09	Oct-09	Apr-10	Oct-10	Apr-11	Oct-11
MW-12	163	198	166	194	138	119	161	148	170
MW-16	371800	8232	148740	3084	43950	17805	43790	2418	21640
MW-20	34670	11689	21020	5538	1390	5956	19321	1459	5806
MW-21	68320	45820	81410	53740	26820	38410	42080	67890	24356

Attachment 3

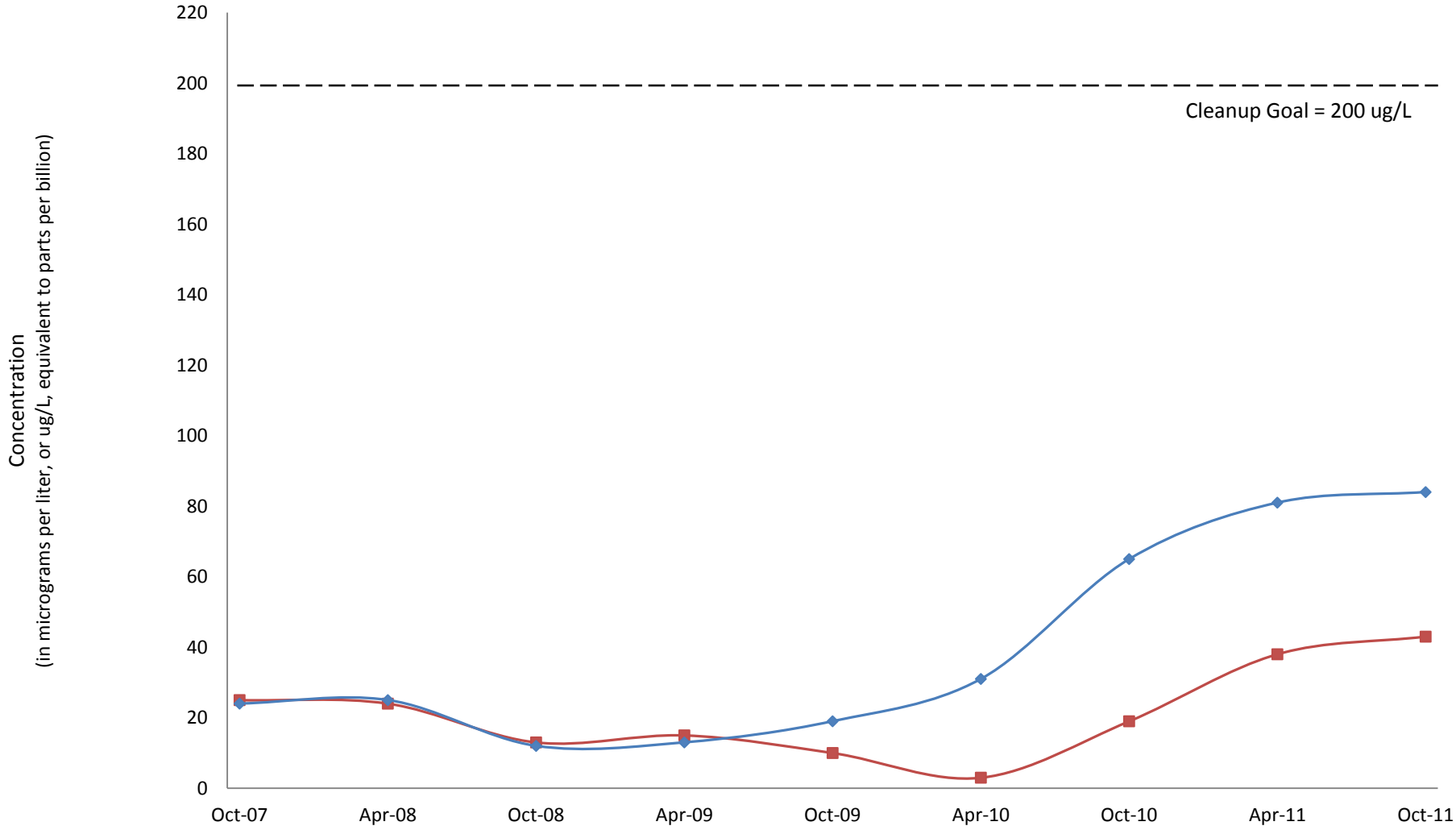
Concentrations of Volatile Organic Compounds in Northern Plume Sentinel Monitoring Wells RMW-37 and MW-53

Total VOC Concentrations and Trends in Sentinel Wells RMW-37 and MW-53 (2007-2012)



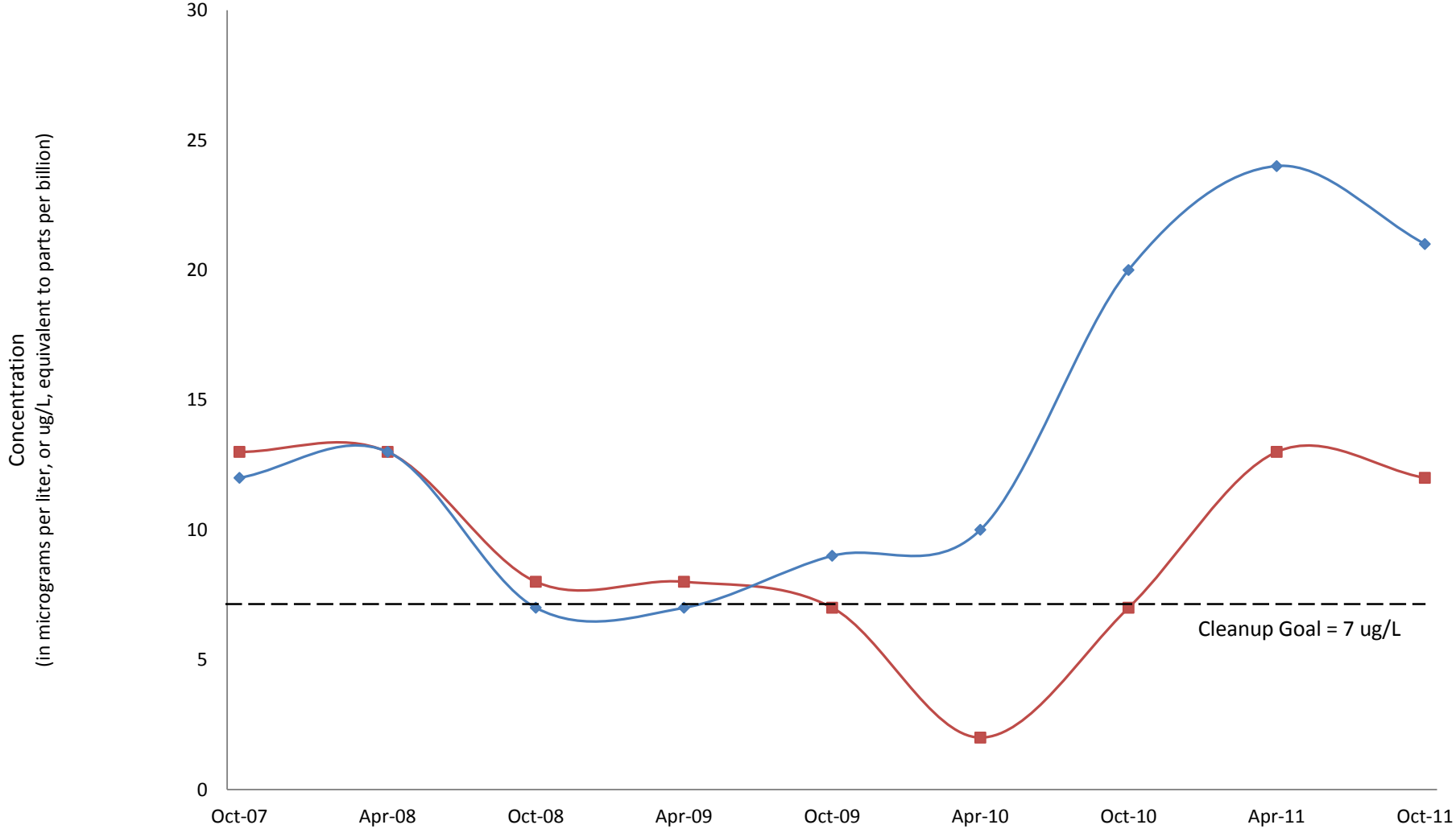
	Oct-07	Apr-08	Oct-08	Apr-09	Oct-09	Apr-10	Oct-10	Apr-11	Oct-11
RMW-37 (overburden)	359	410	270	338	262	48	227	429	443
MW-53 (bedrock)	256	254	186	196	240	280	496	586	542

Concentrations of 1,1,1-TCA in Sentinel Well Pair RMW-37 and MW-53 (2007-2012)



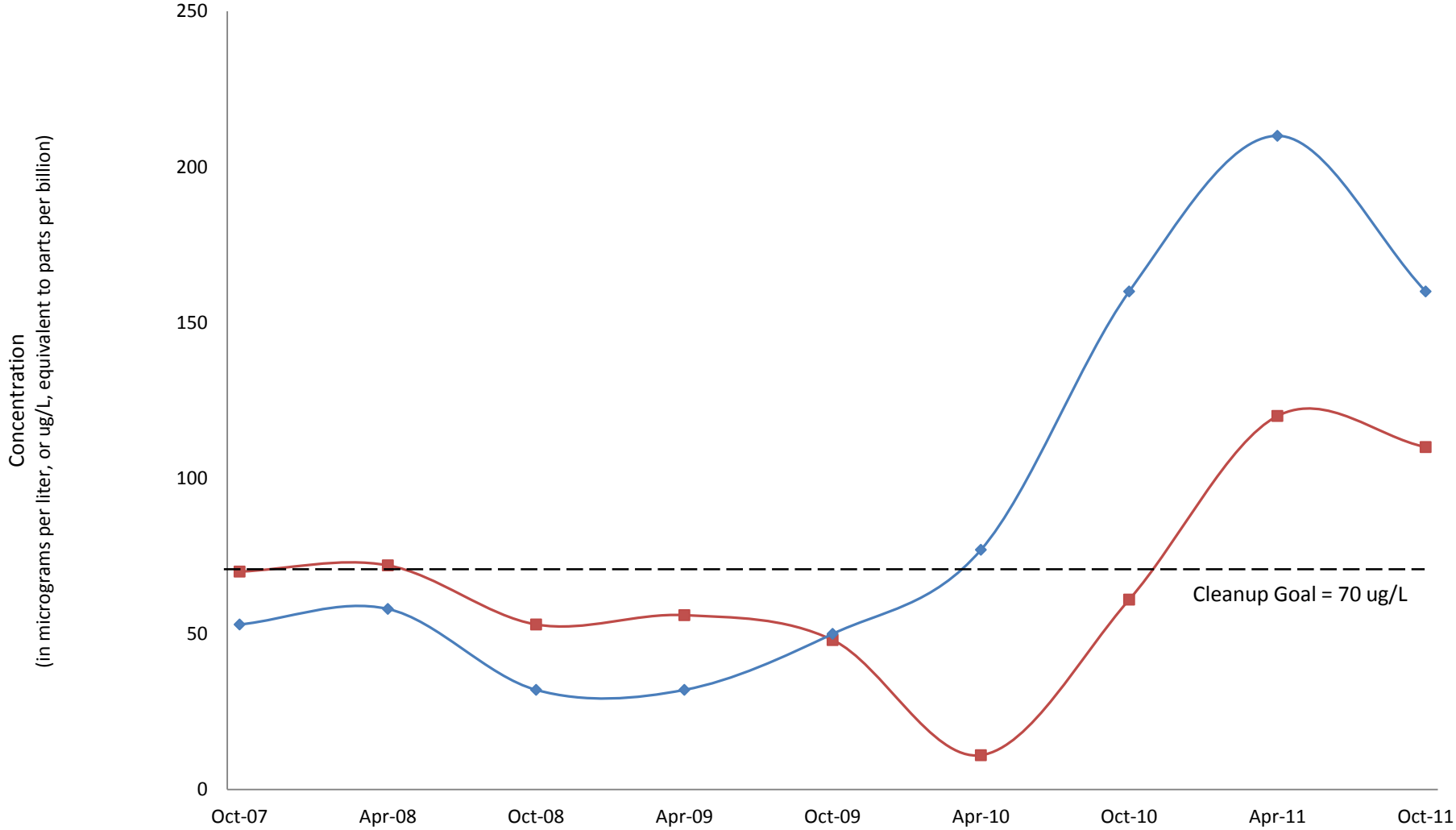
	Oct-07	Apr-08	Oct-08	Apr-09	Oct-09	Apr-10	Oct-10	Apr-11	Oct-11
RMW-37 (overburden)	25	24	13	15	10	3	19	38	43
MW-53 (bedrock)	24	25	12	13	19	31	65	81	84

Concentrations of 1,1-DCE in Sentinel Well Pair RMW-37 and MW-53 (2007-2012)



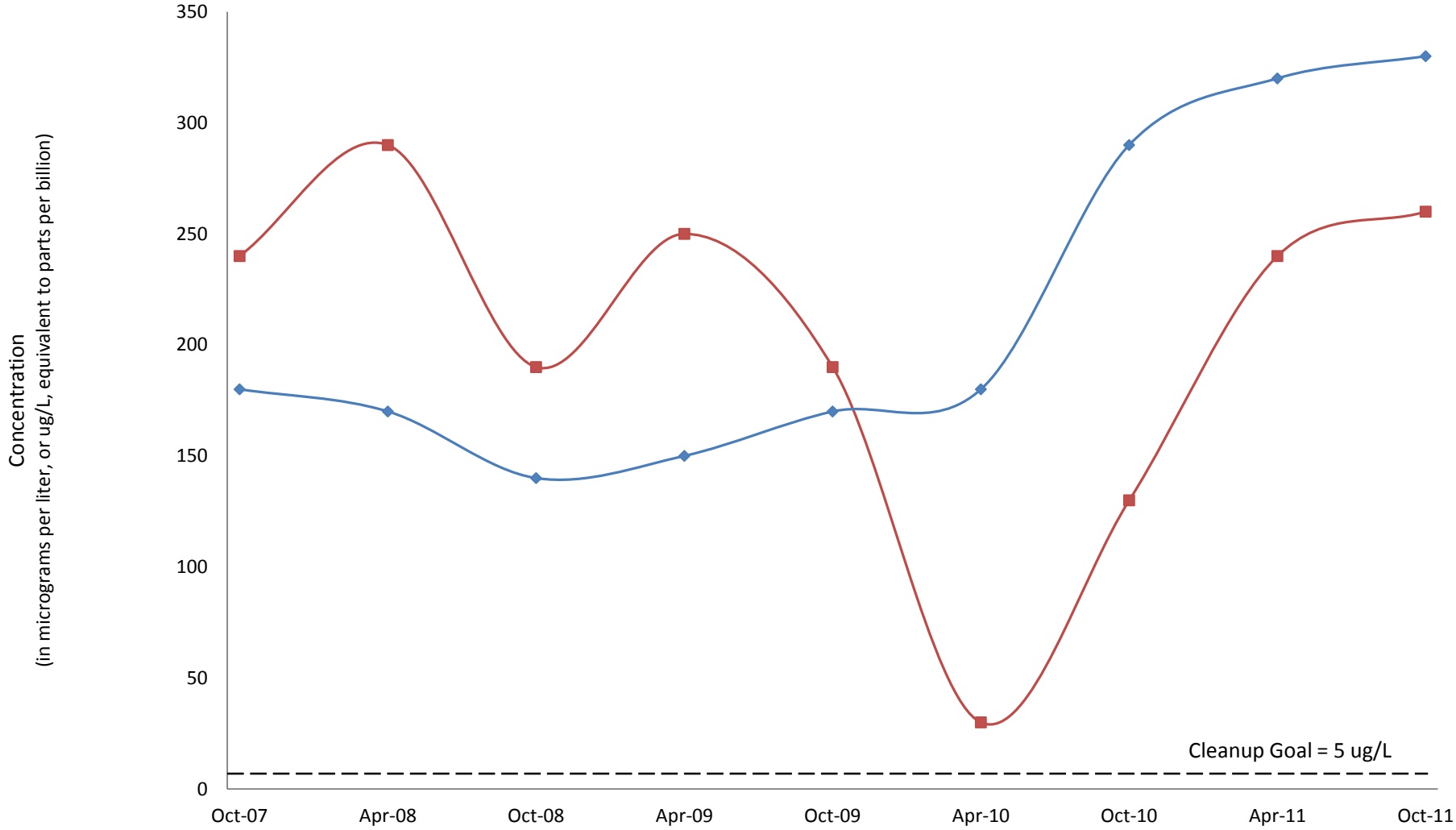
	Oct-07	Apr-08	Oct-08	Apr-09	Oct-09	Apr-10	Oct-10	Apr-11	Oct-11
RMW-37 (overburden)	13	13	8	8	7	2	7	13	12
MW-53 (bedrock)	12	13	7	7	9	10	20	24	21

Concentrations of cis-1,2-DCE in Sentinel Well Pair RMW-37 and MW-53 (2007-2012)



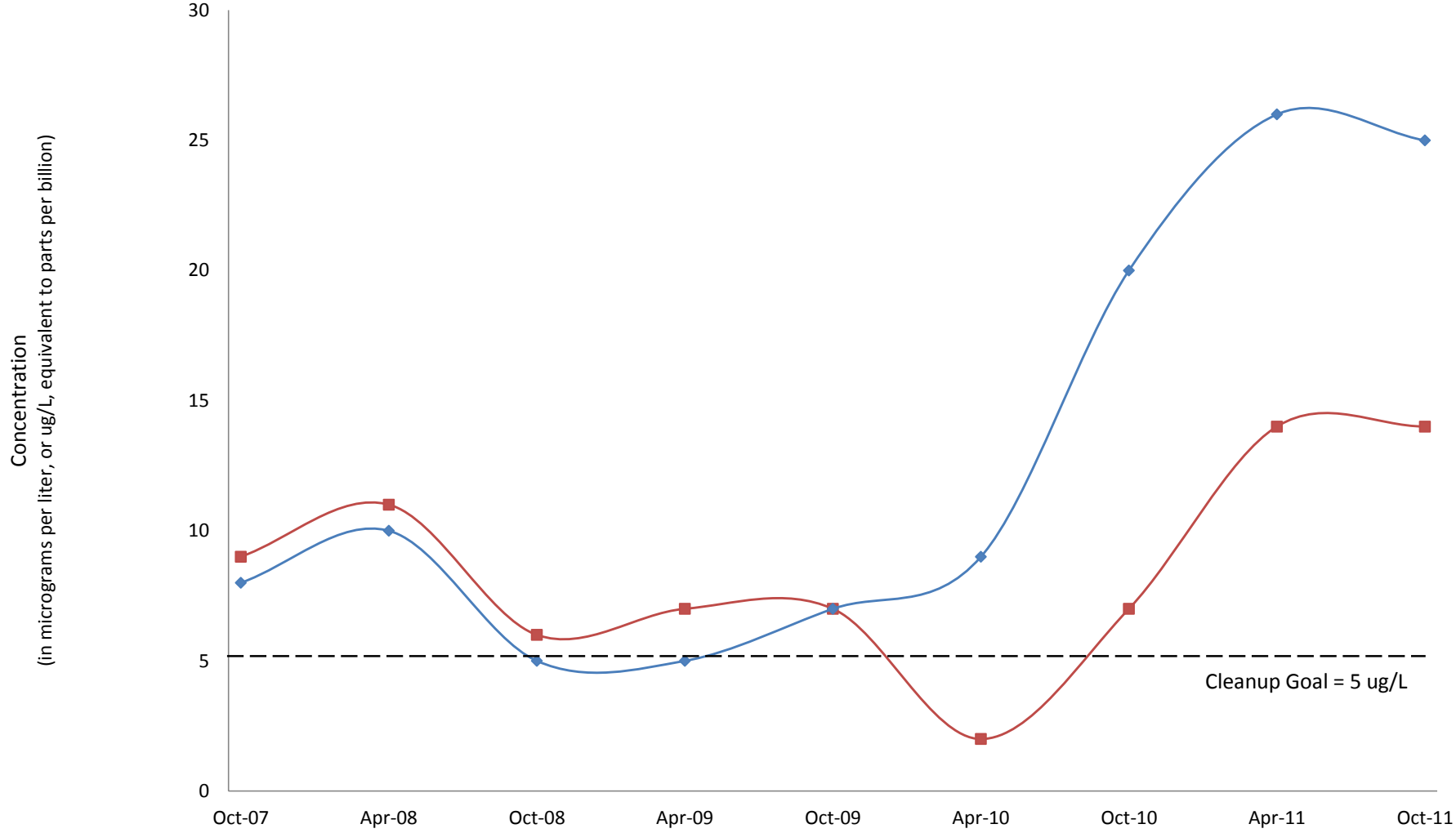
	Oct-07	Apr-08	Oct-08	Apr-09	Oct-09	Apr-10	Oct-10	Apr-11	Oct-11
RMW-37 (overburden)	70	72	53	56	48	11	61	120	110
MW-53 (bedrock)	53	58	32	32	50	77	160	210	160

Concentrations of TCE in Sentinel Well Pair RMW-37 and MW-53 (2007-2012)



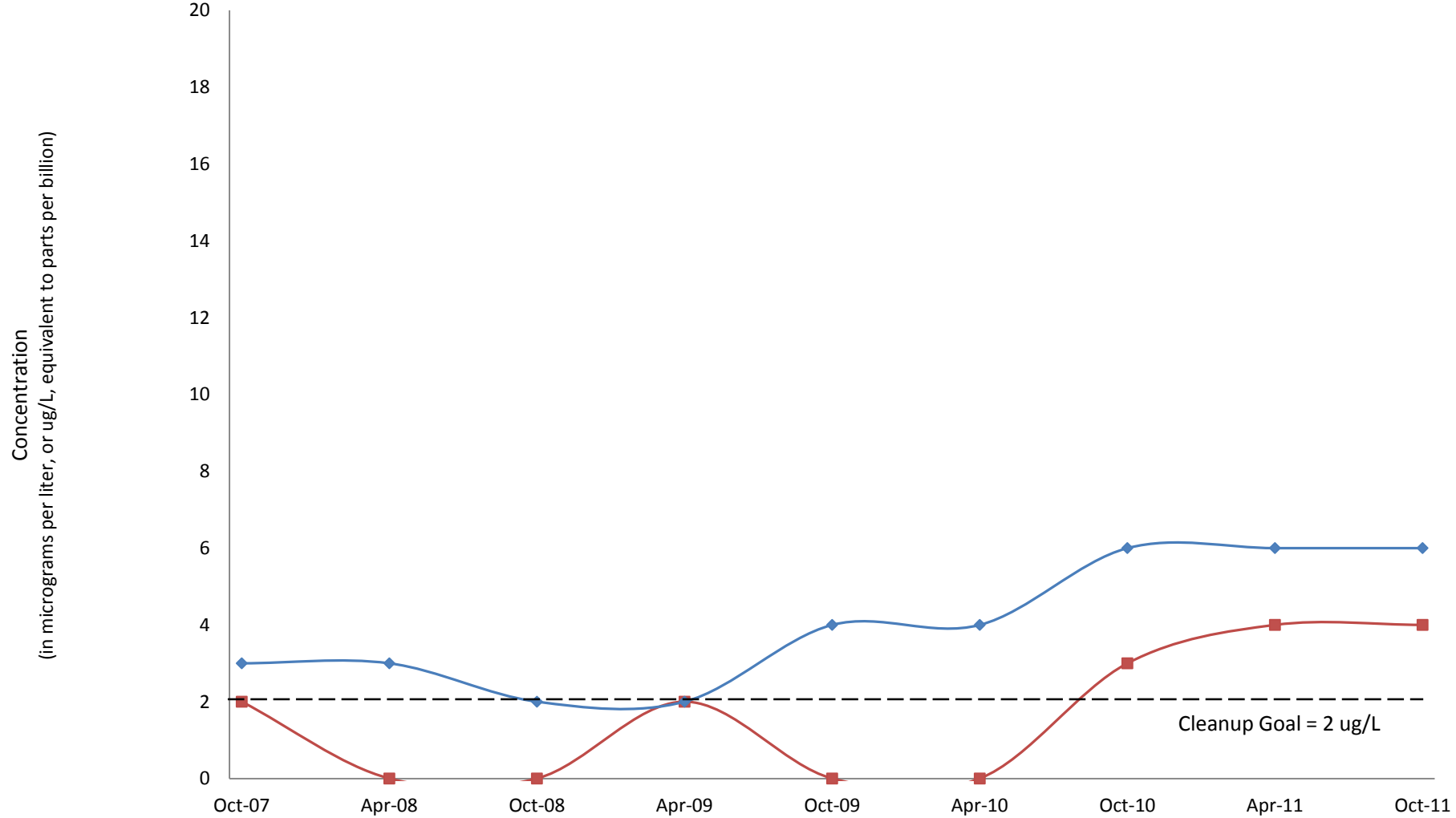
	Oct-07	Apr-08	Oct-08	Apr-09	Oct-09	Apr-10	Oct-10	Apr-11	Oct-11
RMW-37 (overburden)	240	290	190	250	190	30	130	240	260
MW-53 (bedrock)	180	170	140	150	170	180	290	320	330

Concentrations of PCE in Sentinel Well Pair RMW-37 and MW-53 (2007-2012)



	Oct-07	Apr-08	Oct-08	Apr-09	Oct-09	Apr-10	Oct-10	Apr-11	Oct-11
RMW-37 (overburden)	9	11	6	7	7	2	7	14	14
MW-53 (bedrock)	8	10	5	5	7	9	20	26	25

Concentrations of Vinyl Chloride in Sentinel Well Pair RMW-37 and MW-53 (2007-2012)

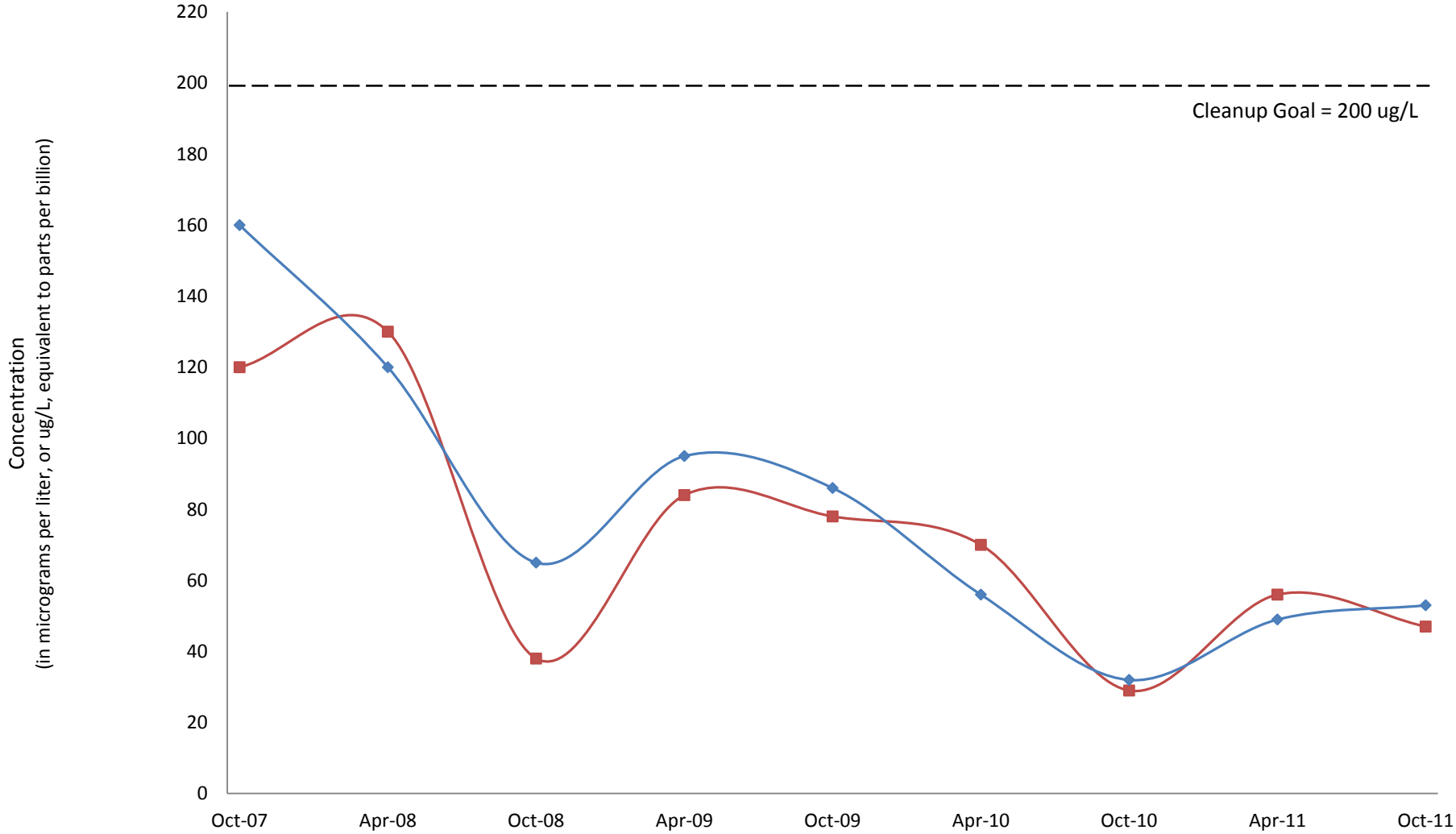


	Oct-07	Apr-08	Oct-08	Apr-09	Oct-09	Apr-10	Oct-10	Apr-11	Oct-11
RMW-37 (overburden)	2	0	0	2	0	0	3	4	4
MW-53 (bedrock)	3	3	2	2	4	4	6	6	6

Attachment 4

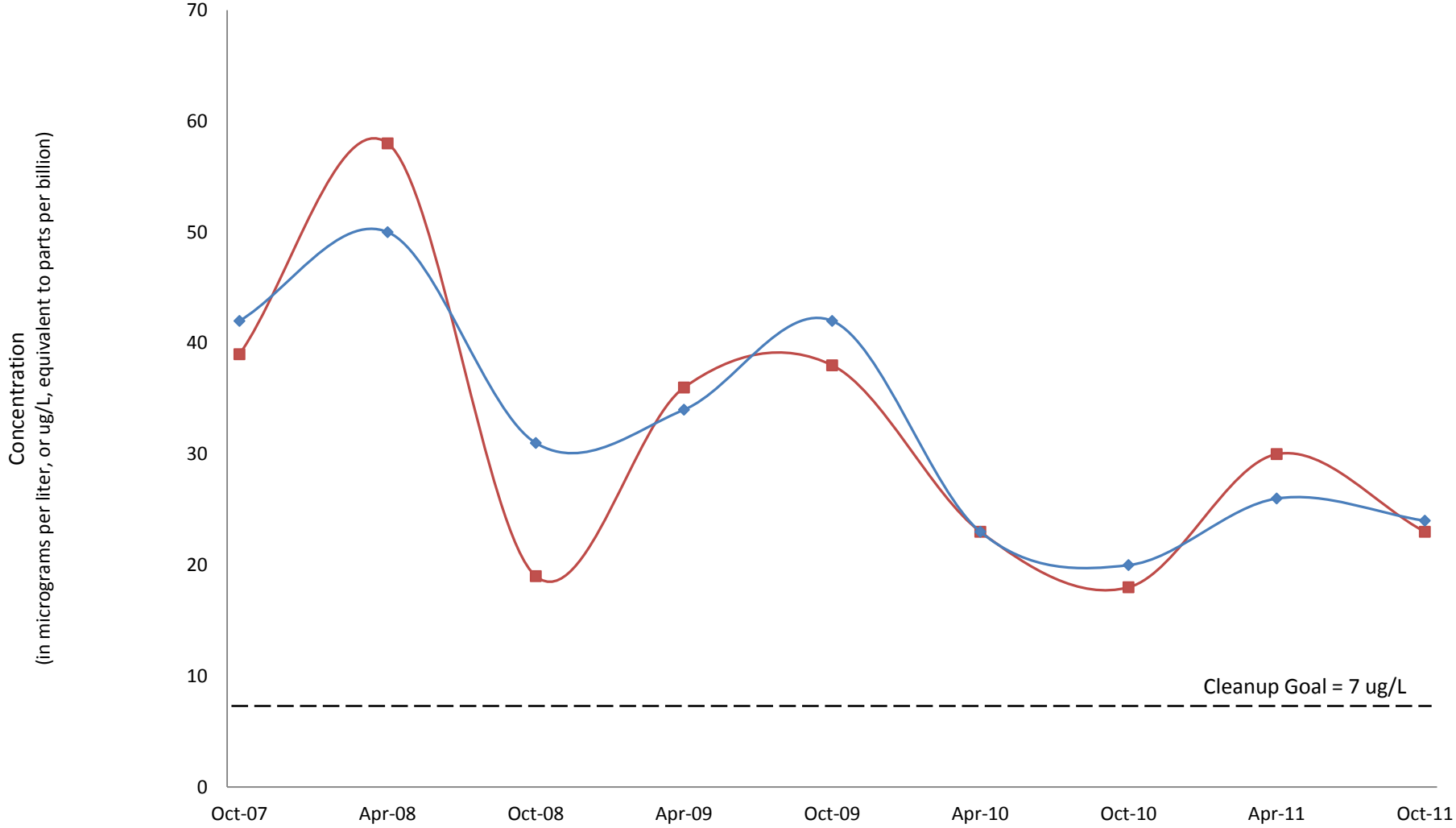
Concentrations of Volatile Organic Compounds and 1,4-Dioxane in Northern Plume Sentinel Monitoring Wells RMW-38 and MW-48

Concentrations of 1,1,1-TCA in Sentinel Well Pair RMW-38 and MW-48 (2007-2012)



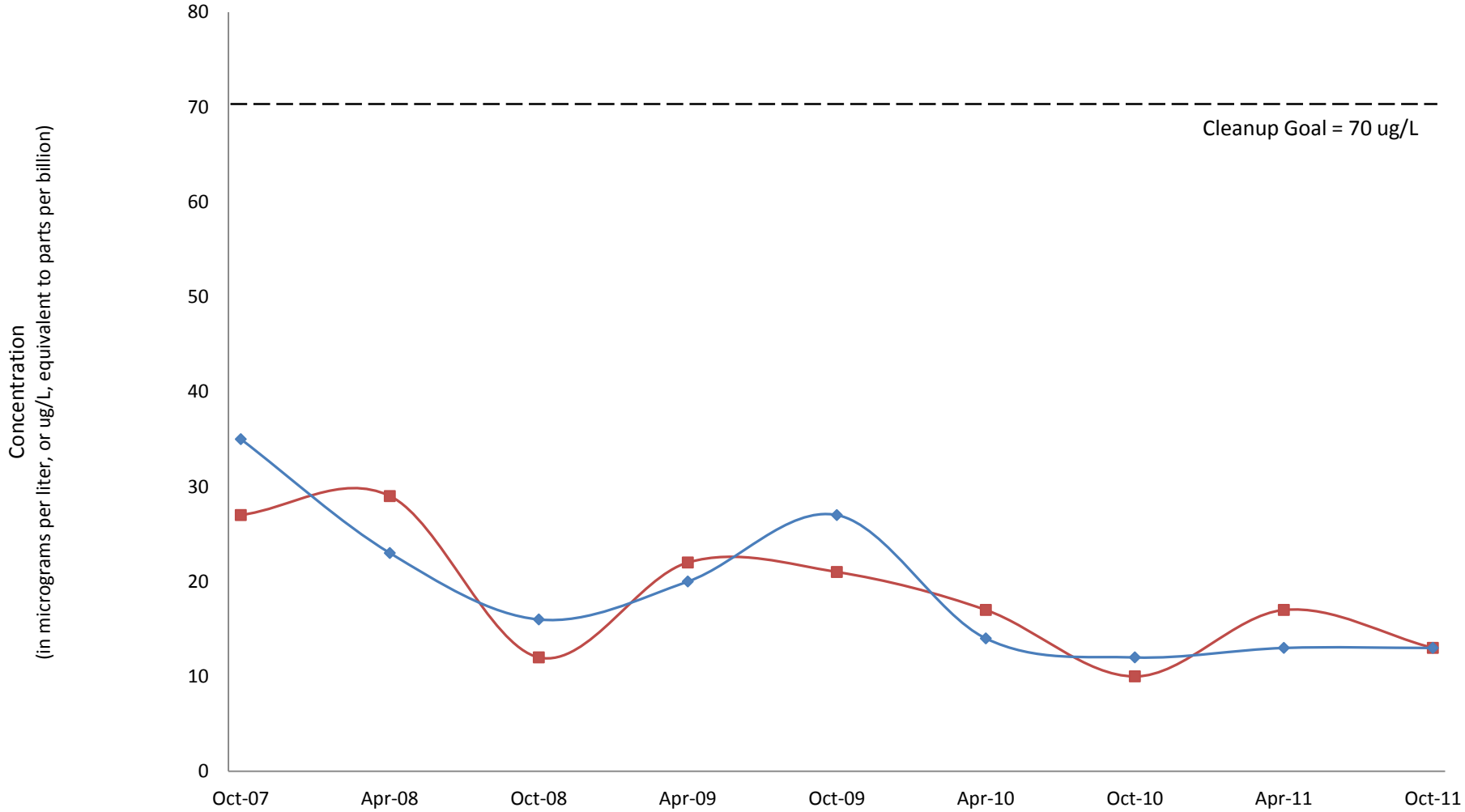
	Oct-07	Apr-08	Oct-08	Apr-09	Oct-09	Apr-10	Oct-10	Apr-11	Oct-11
RMW-38 (overburden)	120	130	38	84	78	70	29	56	47
MW-48 (bedrock)	160	120	65	95	86	56	32	49	53

Concentrations of 1,1-DCE in Sentinel Well Pair RMW-38 and MW-48 (2007-2012)



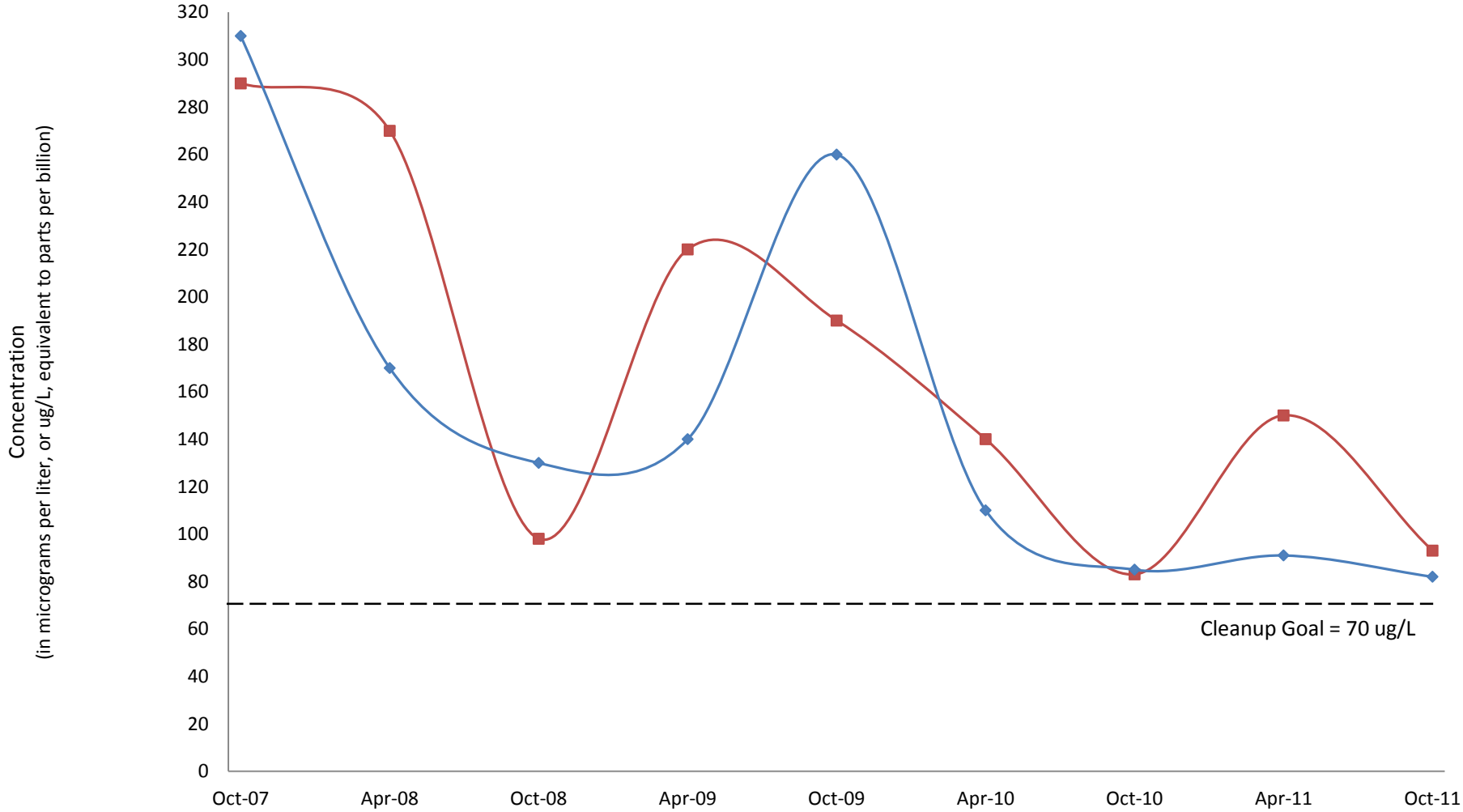
	Oct-07	Apr-08	Oct-08	Apr-09	Oct-09	Apr-10	Oct-10	Apr-11	Oct-11
RMW-38 (overburden)	39	58	19	36	38	23	18	30	23
MW-48 (bedrock)	42	50	31	34	42	23	20	26	24

Concentrations of 1,1-DCA in Sentinel Well Pair RMW-38 and MW-48 (2007-2012)



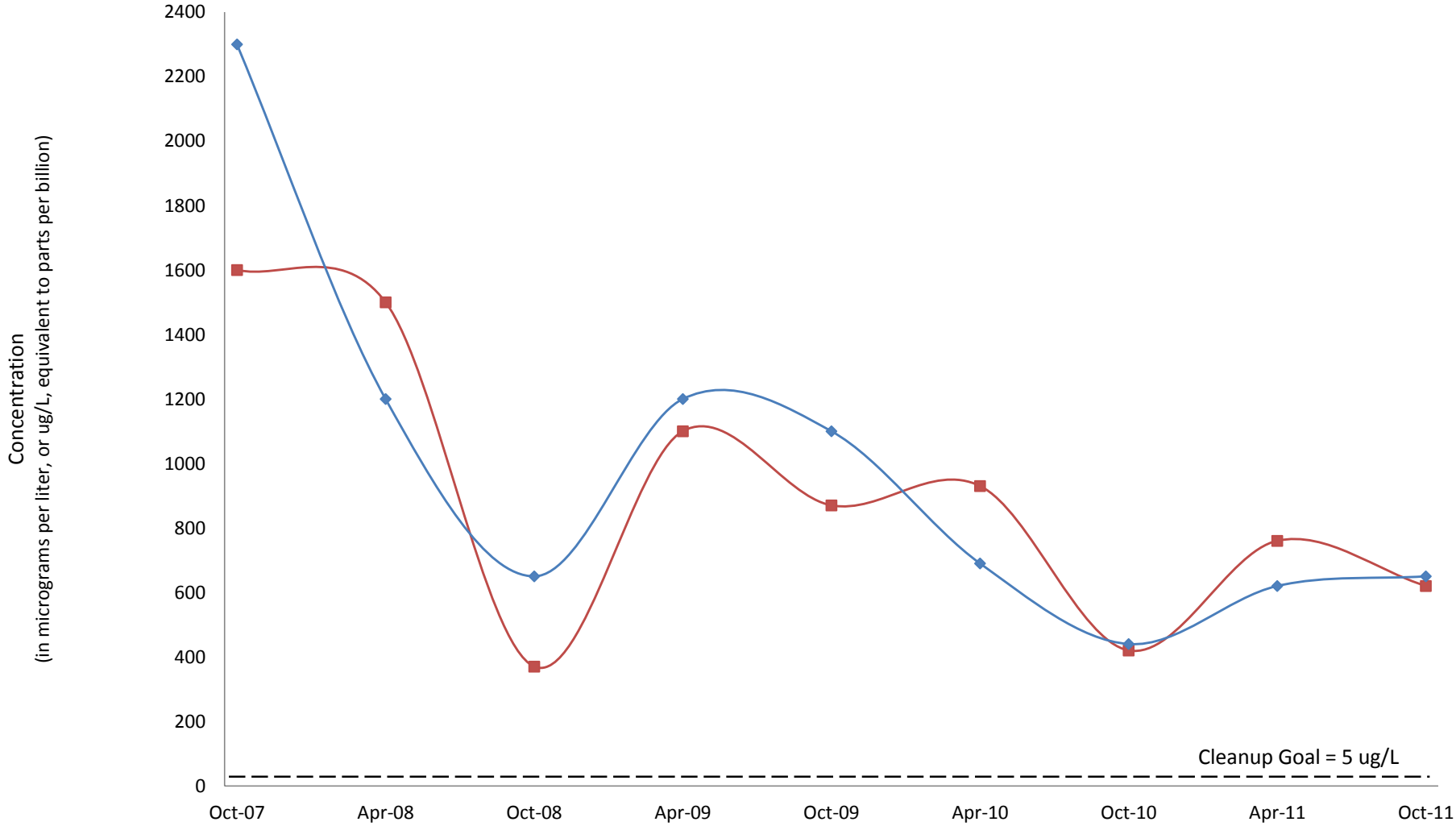
	Oct-07	Apr-08	Oct-08	Apr-09	Oct-09	Apr-10	Oct-10	Apr-11	Oct-11
RMW-38 (overburden)	27	29	12	22	21	17	10	17	13
MW-48 (bedrock)	35	23	16	20	27	14	12	13	13

Concentrations of cis-1,2-DCE in Sentinel Well Pair RMW-38 and MW-48 (2007-2012)



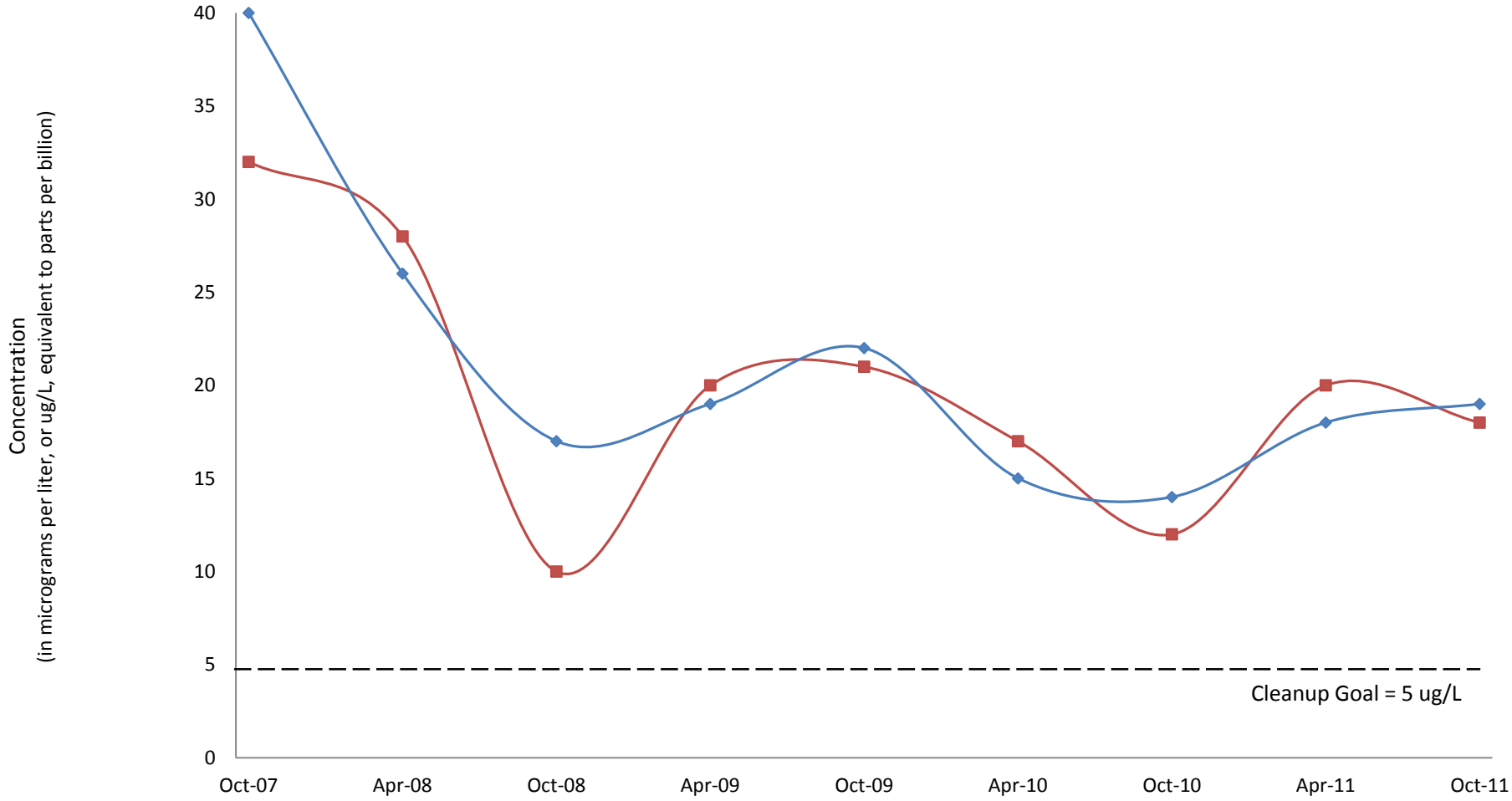
	Oct-07	Apr-08	Oct-08	Apr-09	Oct-09	Apr-10	Oct-10	Apr-11	Oct-11
RMW-38 (overburden)	290	270	98	220	190	140	83	150	93
MW-48 (bedrock)	310	170	130	140	260	110	85	91	82

Concentrations of TCE in Sentinel Well Pair RMW-38 and MW-48 (2007-2012)



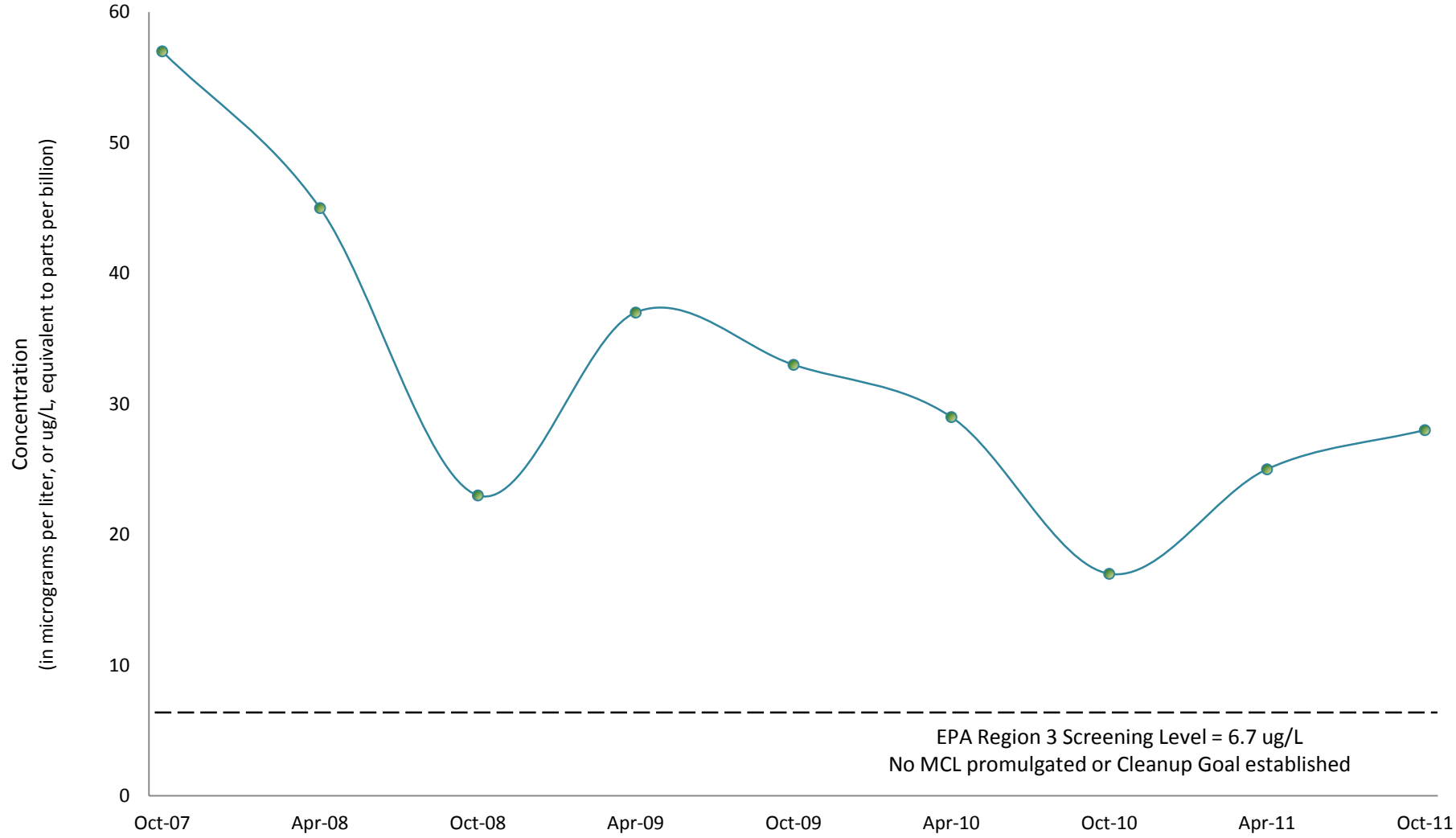
	Oct-07	Apr-08	Oct-08	Apr-09	Oct-09	Apr-10	Oct-10	Apr-11	Oct-11
RMW-38 (overburden)	1600	1500	370	1100	870	930	420	760	620
MW-48 (bedrock)	2300	1200	650	1200	1100	690	440	620	650

Concentrations of PCE in Sentinel Well Pair RMW-38 and MW-48 (2007-2012)



	Oct-07	Apr-08	Oct-08	Apr-09	Oct-09	Apr-10	Oct-10	Apr-11	Oct-11
RMW-38 (overburden)	32	28	10	20	21	17	12	20	18
MW-48 (bedrock)	40	26	17	19	22	15	14	18	19

Concentrations of 1,4-Dioxane in Sentinel Well RMW-38 (2007-2012)

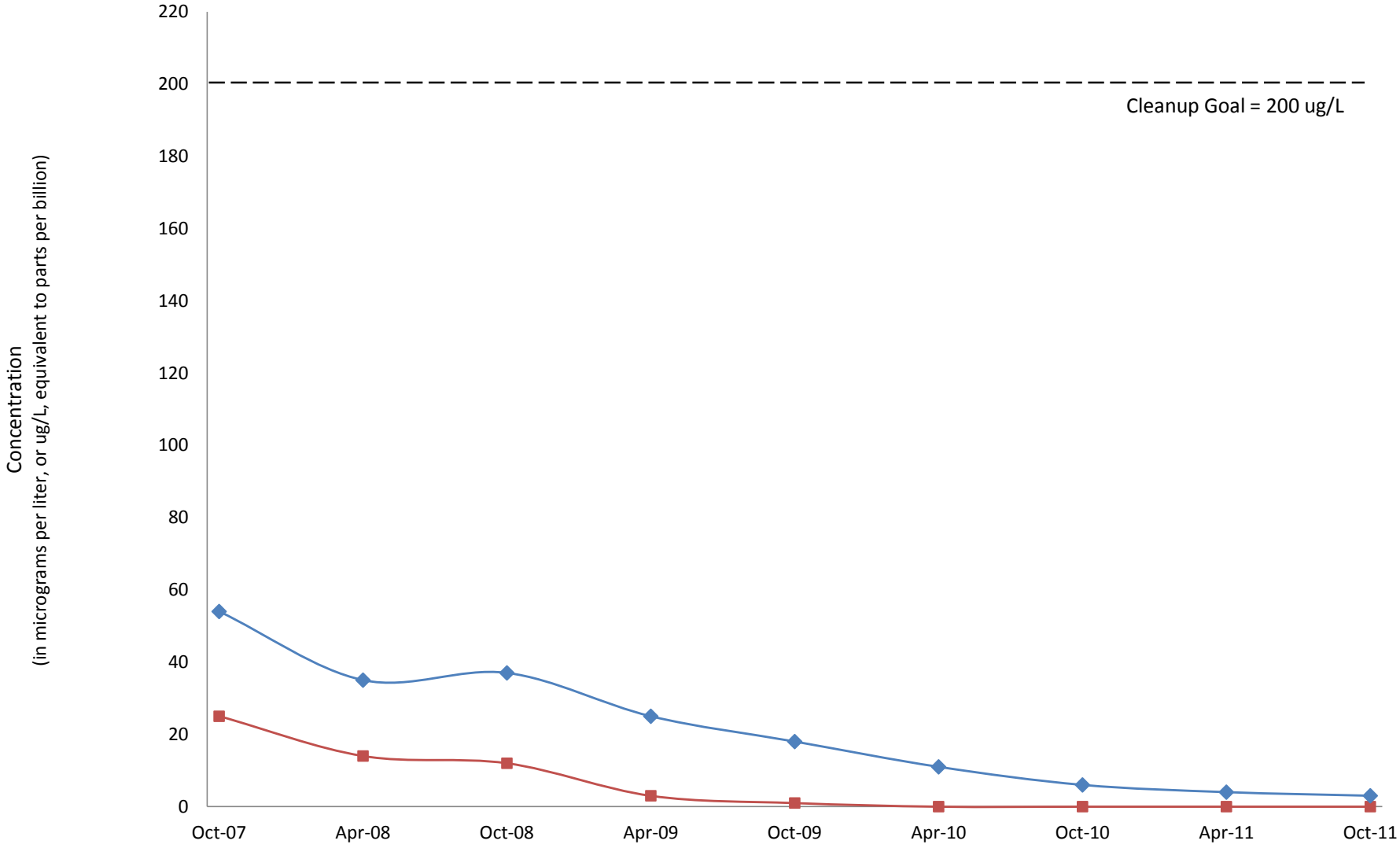


	Oct-07	Apr-08	Oct-08	Apr-09	Oct-09	Apr-10	Oct-10	Apr-11	Oct-11
1,4-Dioxane	57	45	23	37	33	29	17	25	28

Attachment 5

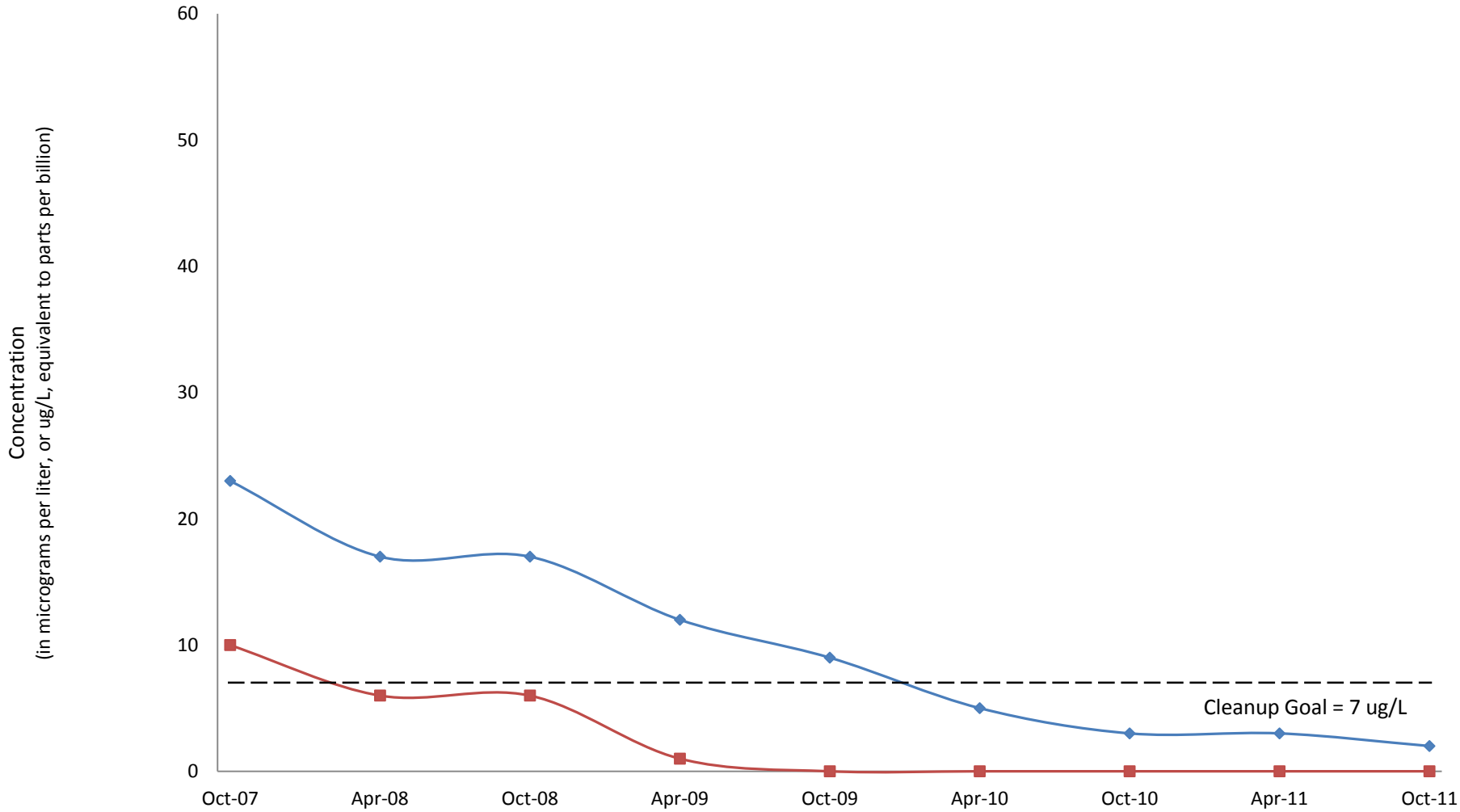
Concentrations of Volatile Organic Compounds in Northern Plume Perimeter Monitoring Wells MW-49 and MW-50

Concentrations of 1,1,1-TCA in Sentinel Well Pair MW-49 and MW-50 (2007-2012)



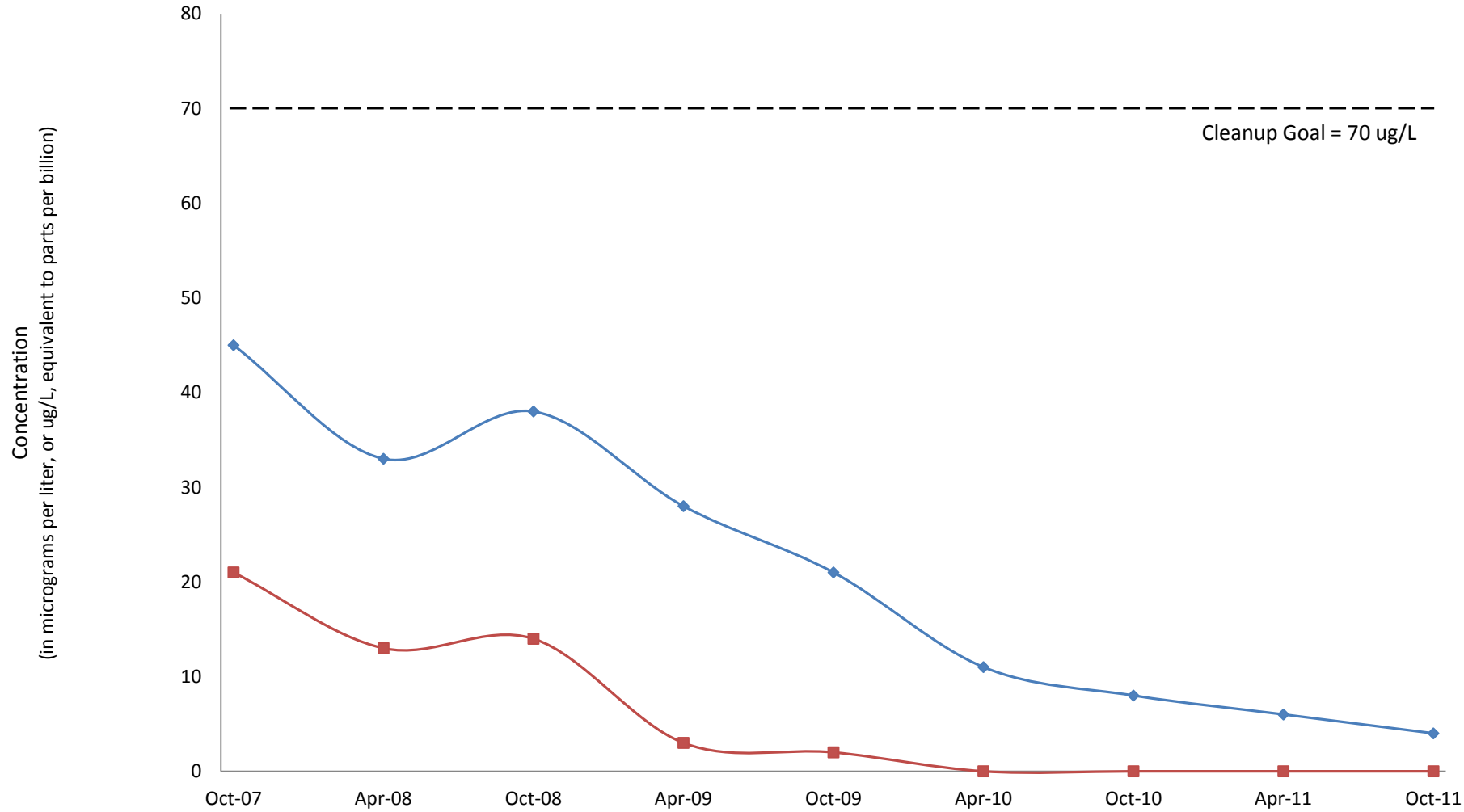
	Oct-07	Apr-08	Oct-08	Apr-09	Oct-09	Apr-10	Oct-10	Apr-11	Oct-11
MW-49 (overburden)	25	14	12	3	1	0	0	0	0
MW-50 (bedrock)	54	35	37	25	18	11	6	4	3

Concentrations of 1,1-DCE in Sentinel Well Pair MW-49 and MW-50 (2007-2012)



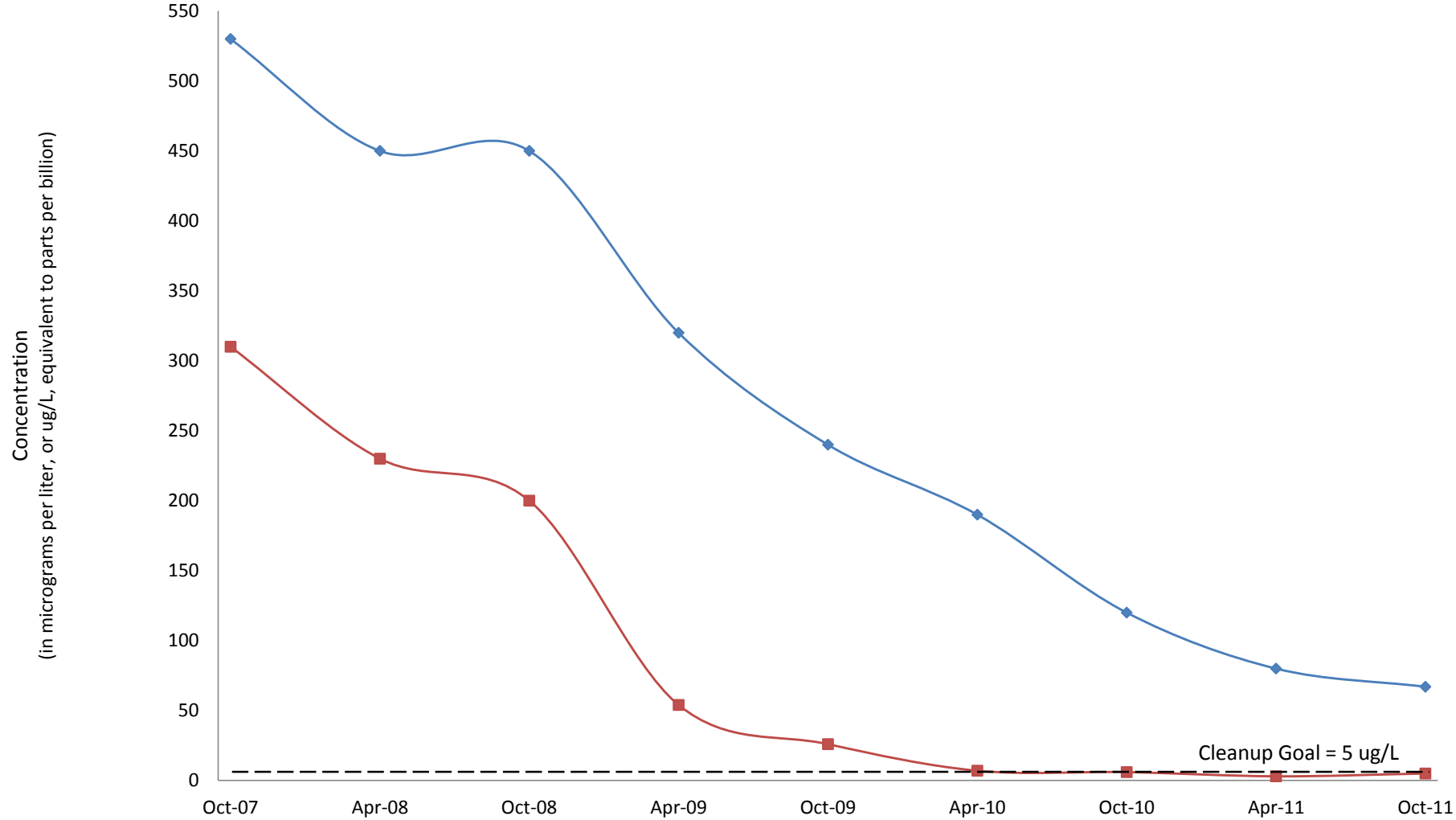
	Oct-07	Apr-08	Oct-08	Apr-09	Oct-09	Apr-10	Oct-10	Apr-11	Oct-11
MW-49 (overburden)	10	6	6	1	0	0	0	0	0
MW-50 (bedrock)	23	17	17	12	9	5	3	3	2

Concentrations of cis-1,2-DCE in Sentinel Well Pair MW-49 and MW-50 (2007-2012)



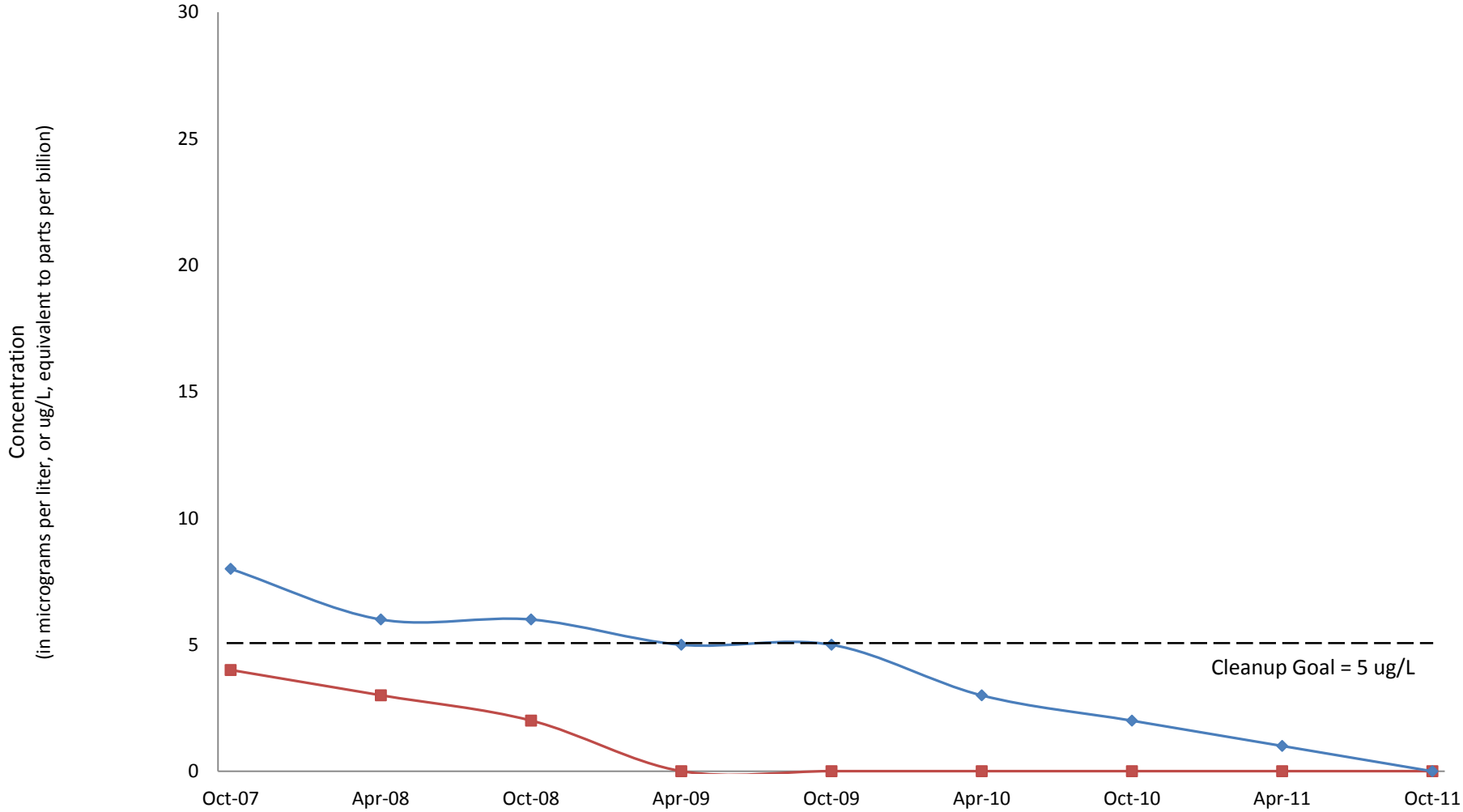
	Oct-07	Apr-08	Oct-08	Apr-09	Oct-09	Apr-10	Oct-10	Apr-11	Oct-11
MW-49 (overburden)	21	13	14	3	2	0	0	0	0
MW-50 (bedrock)	45	33	38	28	21	11	8	6	4

Concentrations of TCE in Sentinel Well Pair MW-49 and MW-50 (2007-2012)



	Oct-07	Apr-08	Oct-08	Apr-09	Oct-09	Apr-10	Oct-10	Apr-11	Oct-11
MW-49 (overburden)	310	230	200	54	26	7	6	3	5
MW-50 (bedrock)	530	450	450	320	240	190	120	80	67

Concentrations of PCE in Sentinel Well Pair MW-49 and MW-50 (2007-2012)

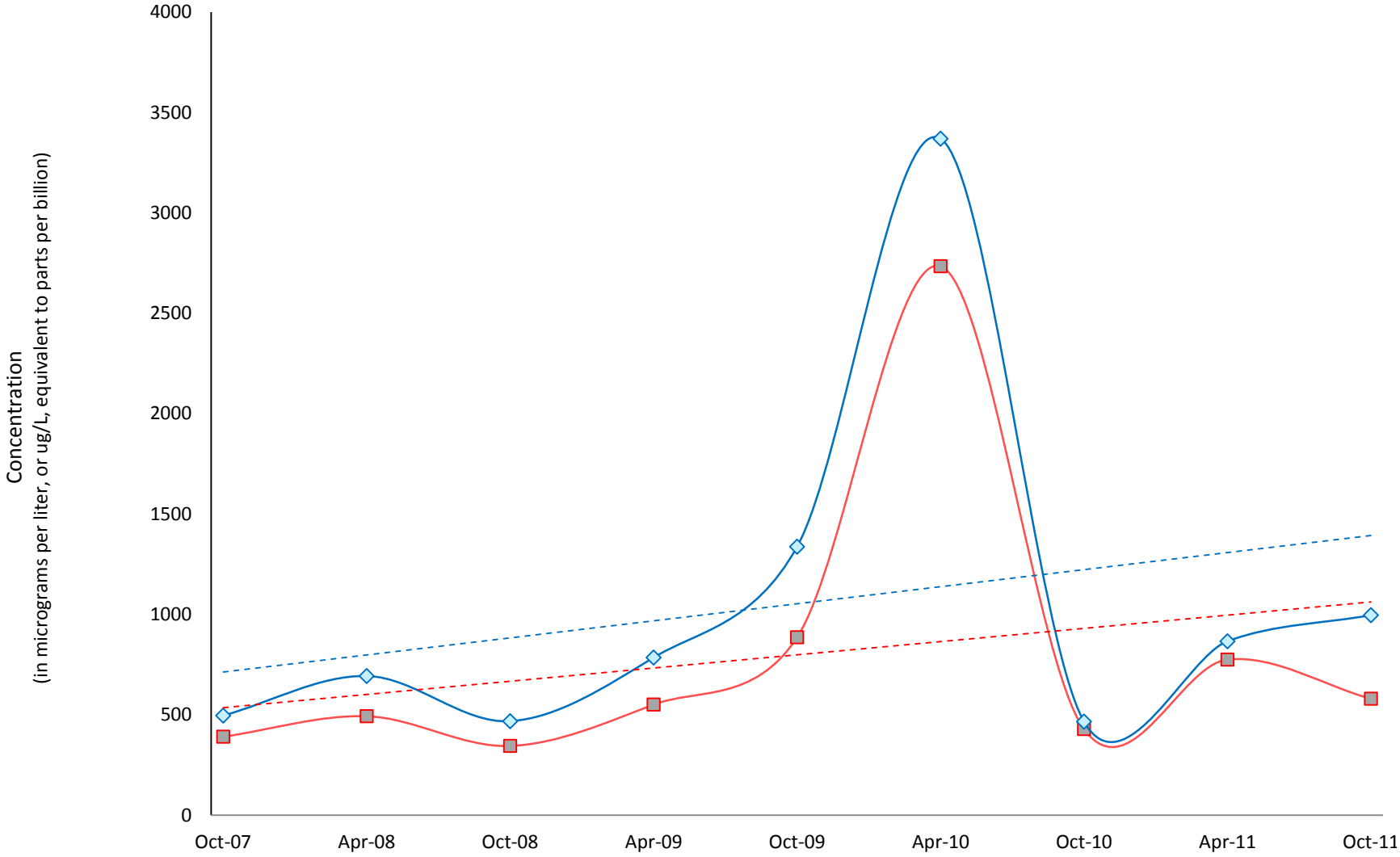


	Oct-07	Apr-08	Oct-08	Apr-09	Oct-09	Apr-10	Oct-10	Apr-11	Oct-11
MW-49 (overburden)	4	3	2	0	0	0	0	0	0
MW-50 (bedrock)	8	6	6	5	5	3	2	1	0

Attachment 6

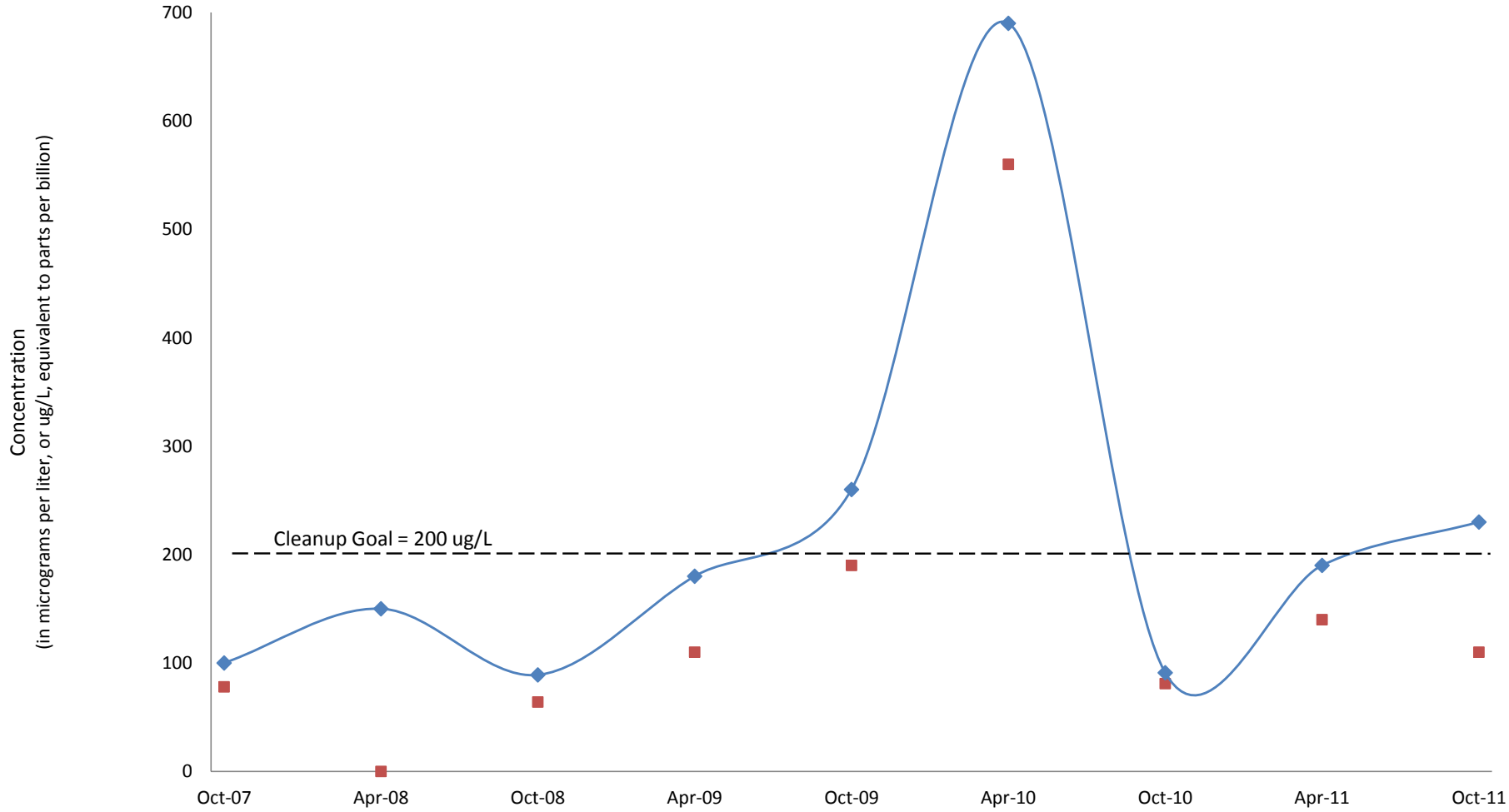
Concentrations of Volatile Organic Compounds in Southern Plume Sentinel Monitoring Wells MW-56 and MW-57

Total VOC Concentrations and Trends in Perimeter Wells MW-56 and MW-57 (2007-2012)



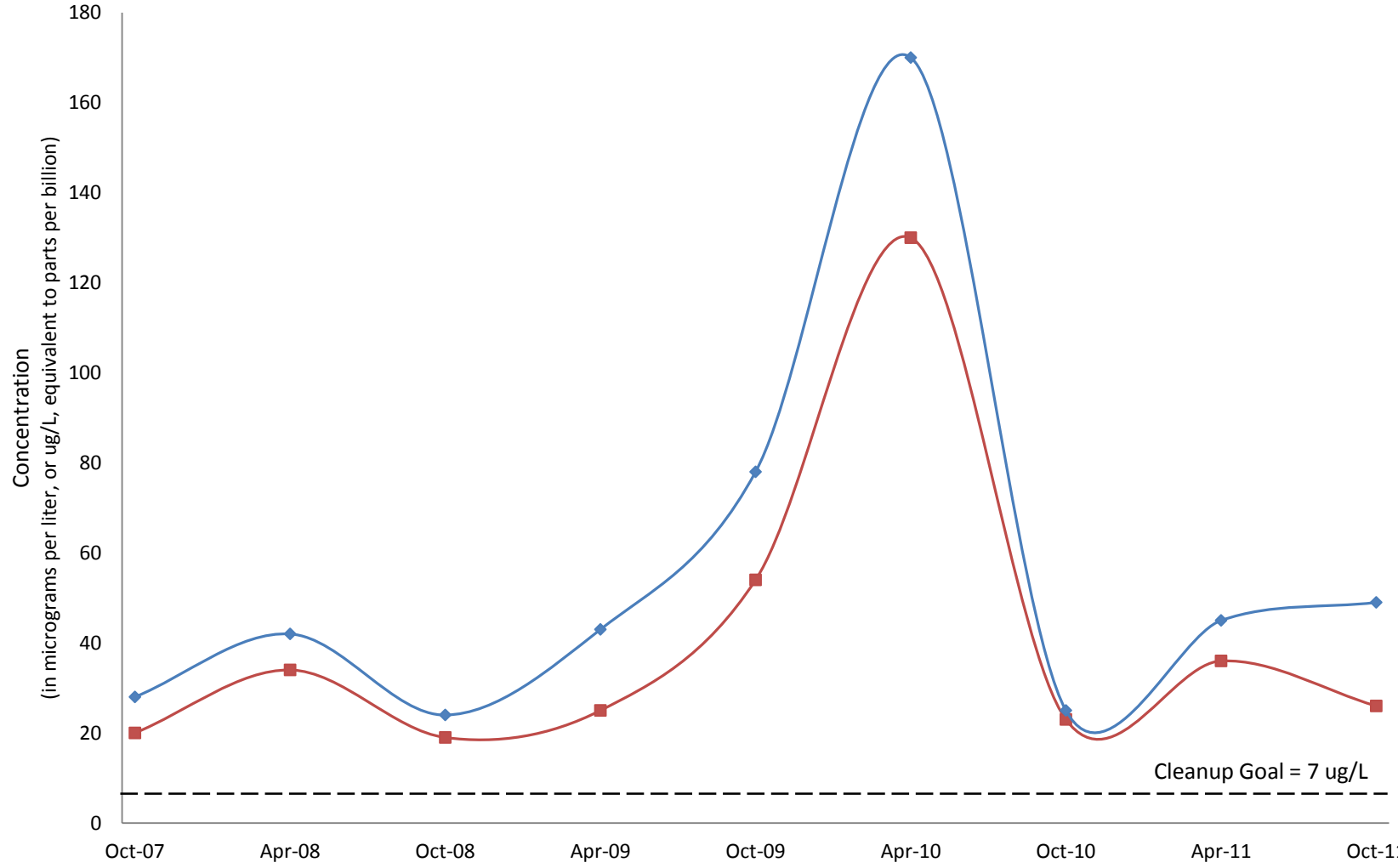
	Oct-07	Apr-08	Oct-08	Apr-09	Oct-09	Apr-10	Oct-10	Apr-11	Oct-11
MW-56 (overburden)	391	493	345	551	886	2734	429	775	580
MW-57 (bedrock)	496	693	468	785	1337	3369	466	866	996

Concentrations of 1,1,1-TCA in Sentinel Well Pair MW-56 and MW-57 (2007-2012)



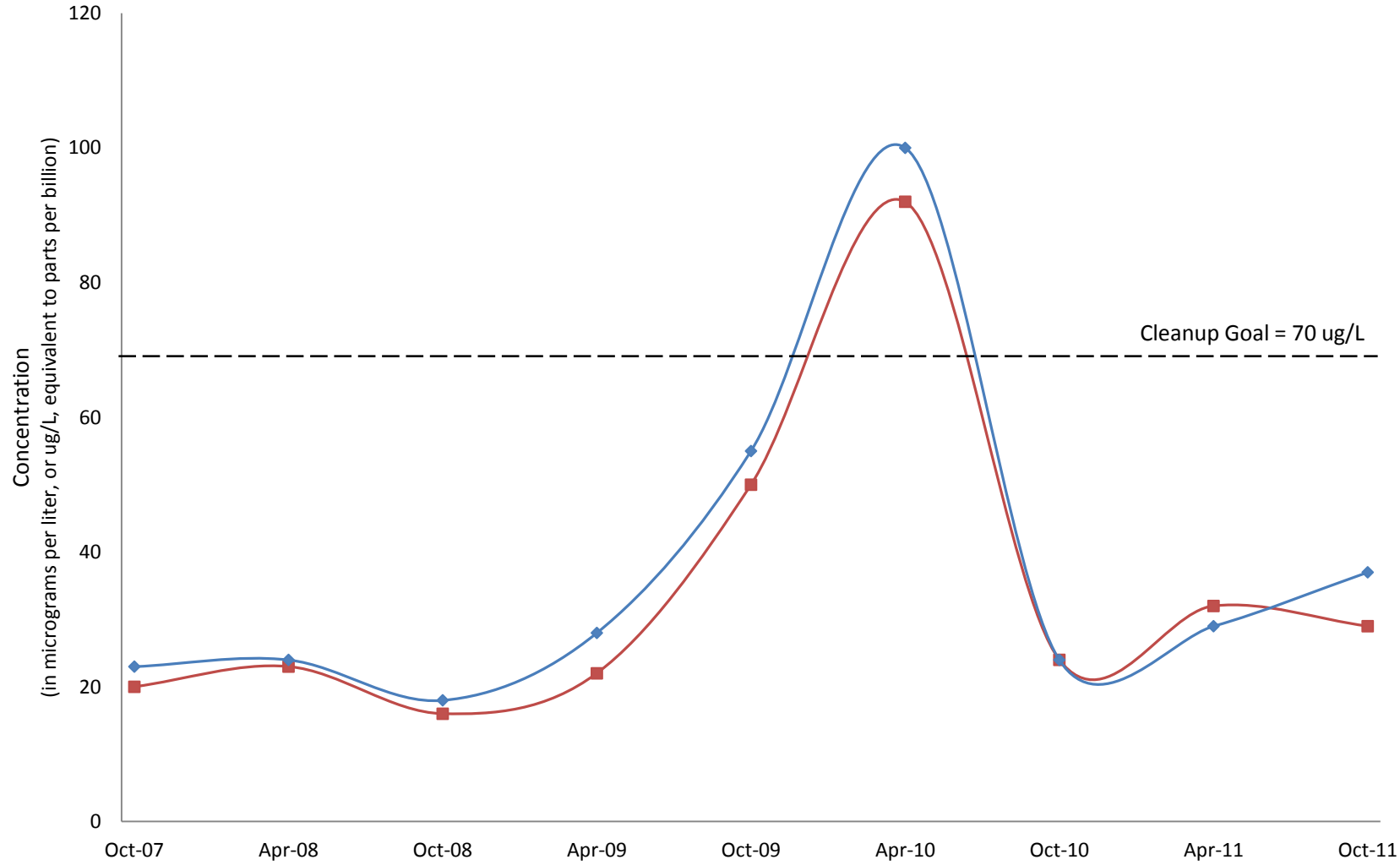
	Oct-07	Apr-08	Oct-08	Apr-09	Oct-09	Apr-10	Oct-10	Apr-11	Oct-11
MW-56 (overburden)	78	0	64	110	190	560	81	140	110
MW-57 (bedrock)	100	150	89	180	260	690	91	190	230

Concentrations of 1,1-DCE in Sentinel Well Pair MW-56 and MW-57 (2007-2012)



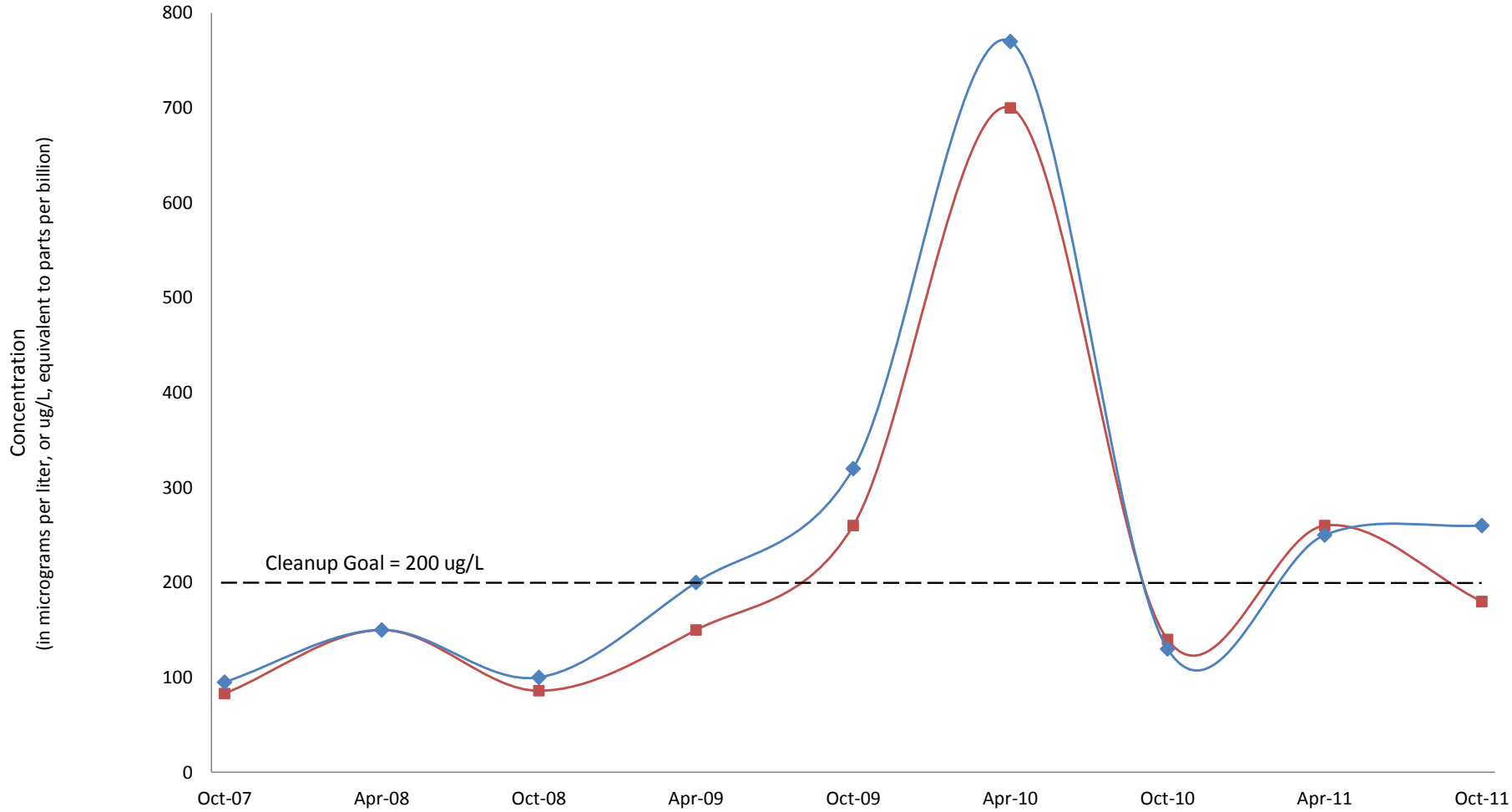
	Oct-07	Apr-08	Oct-08	Apr-09	Oct-09	Apr-10	Oct-10	Apr-11	Oct-11
MW-56 (overburden)	20	34	19	25	54	130	23	36	26
MW-57 (bedrock)	28	42	24	43	78	170	25	45	49

Concentrations of 1,1-DCA in Sentinel Well Pair MW-56 and MW-57 (2007-2012)



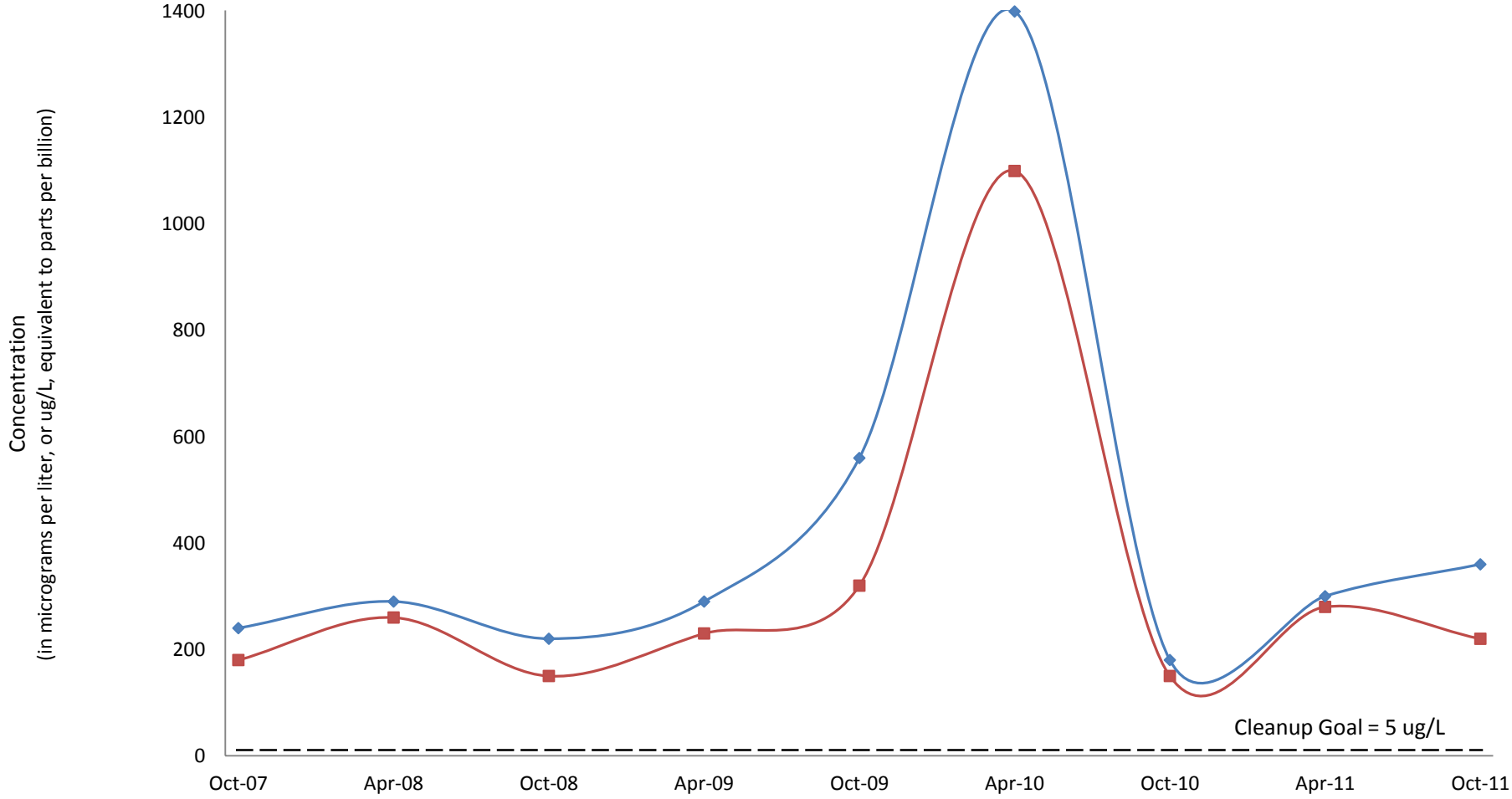
	Oct-07	Apr-08	Oct-08	Apr-09	Oct-09	Apr-10	Oct-10	Apr-11	Oct-11
MW-56 (overburden)	20	23	16	22	50	92	24	32	29
MW-57 (bedrock)	23	24	18	28	55	100	24	29	37

Concentrations of cis-1,2-DCE in Sentinel Well Pair MW-56 and MW-57 (2007-2012)



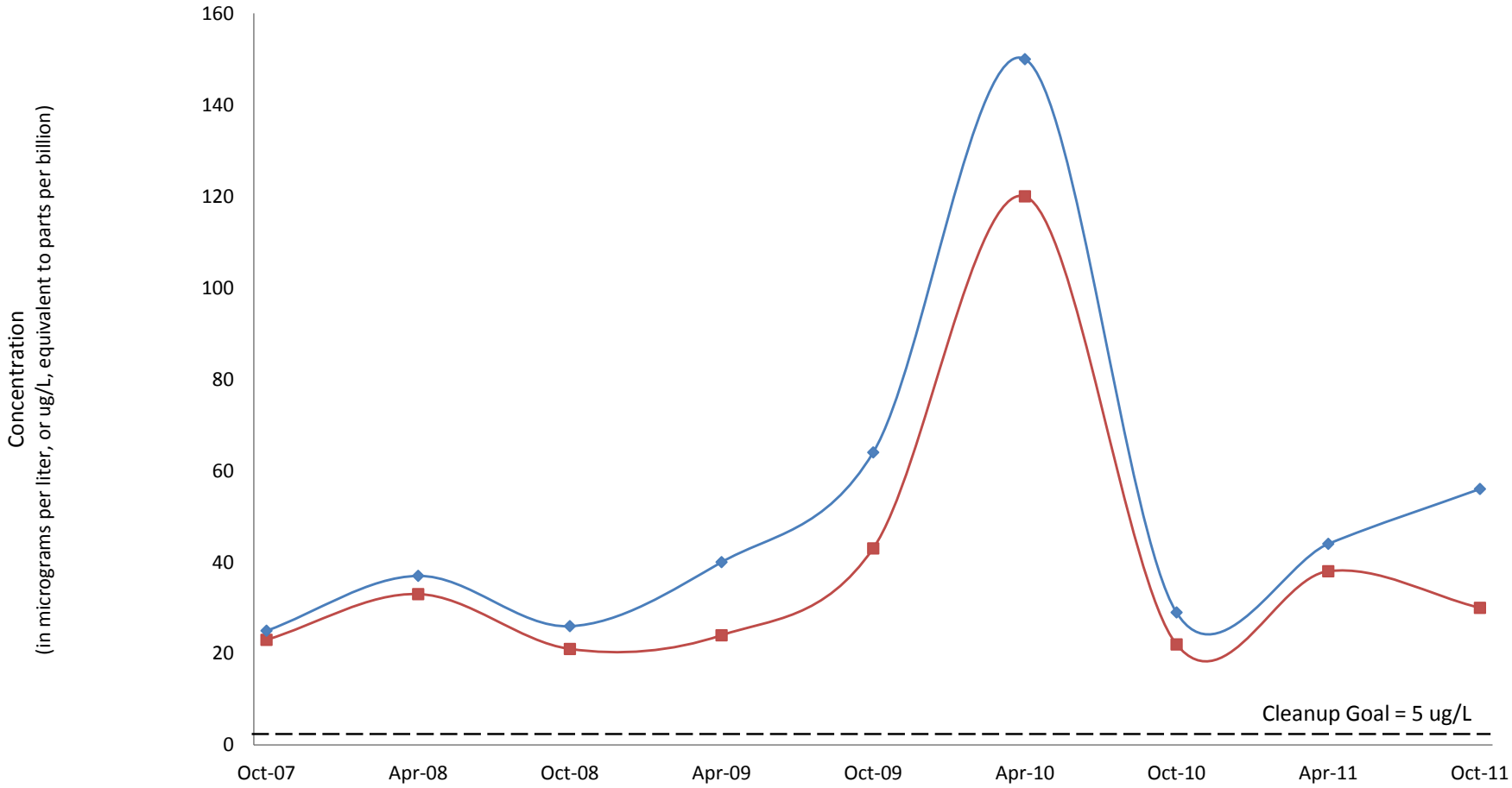
	Oct-07	Apr-08	Oct-08	Apr-09	Oct-09	Apr-10	Oct-10	Apr-11	Oct-11
MW-56 (overburden)	83	150	86	150	260	700	140	260	180
MW-57 (bedrock)	95	150	100	200	320	770	130	250	260

Concentrations of TCE in Sentinel Well Pair MW-56 and MW-57 (2007-2012)



	Oct-07	Apr-08	Oct-08	Apr-09	Oct-09	Apr-10	Oct-10	Apr-11	Oct-11
MW-56 (overburden)	180	260	150	230	320	1100	150	280	220
MW-57 (bedrock)	240	290	220	290	560	1400	180	300	360

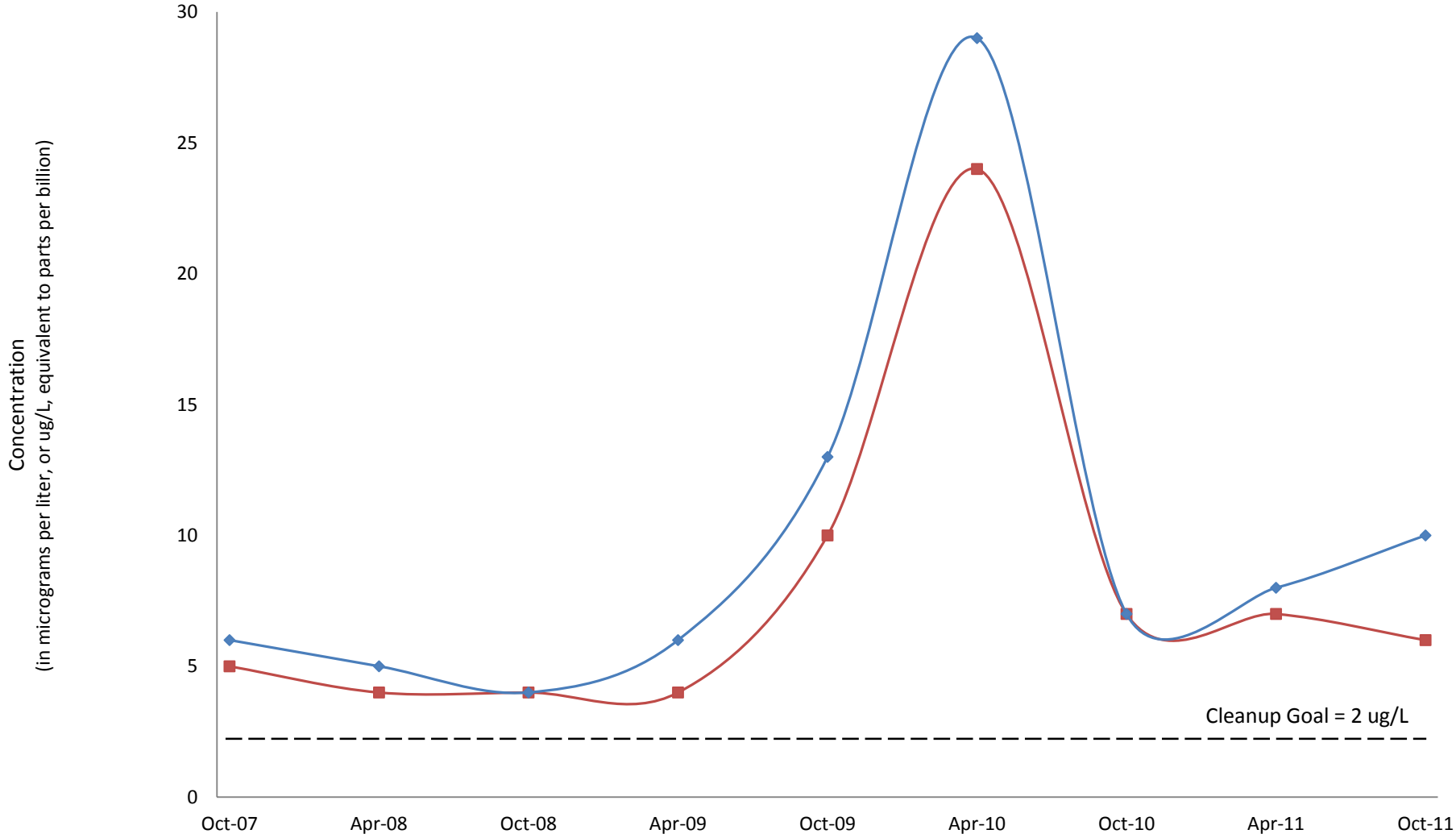
Concentrations of PCE in Sentinel Well Pair MW-56 and MW-57 (2007-2012)



	Oct-07	Apr-08	Oct-08	Apr-09	Oct-09	Apr-10	Oct-10	Apr-11	Oct-11
MW-56 (overburden)	23	33	21	24	43	120	22	38	30
MW-57 (bedrock)	25	37	26	40	64	150	29	44	56

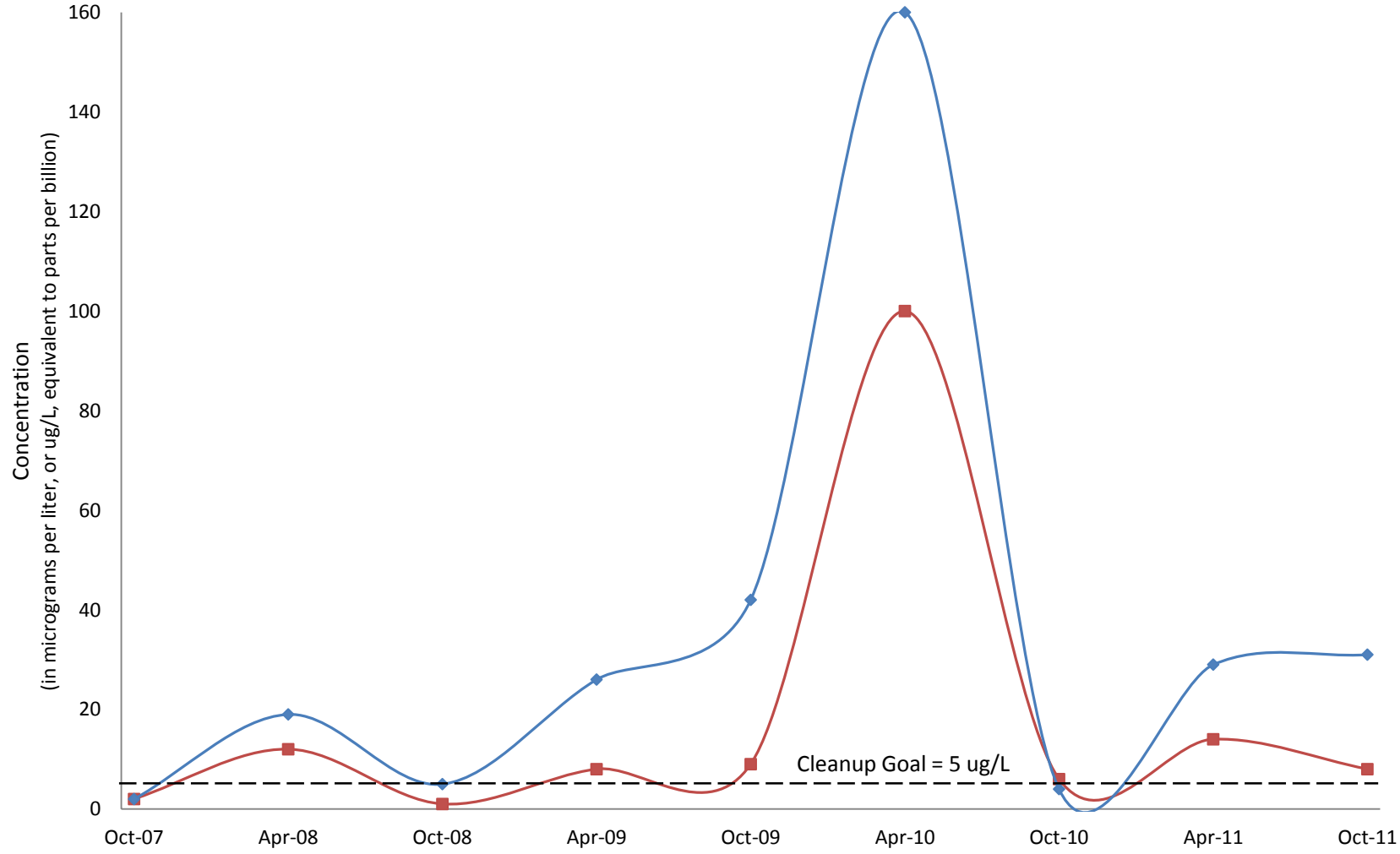
Compound	Well_ID	Oct-07	Apr-08	Oct-08	Apr-09	Oct-09	Apr-10	Oct-10	Apr-11	Oct-11
PCE	MW-56 (overl	23	33	21	24	43	120	22	38	30
PCE	MW-57 (bedr	25	37	26	40	64	150	29	44	56

Concentrations of Vinyl Chloride in Sentinel Well Pair MW-56 and MW-57 (2007-2012)



	Oct-07	Apr-08	Oct-08	Apr-09	Oct-09	Apr-10	Oct-10	Apr-11	Oct-11
MW-56 (overburden)	5	4	4	4	10	24	7	7	6
MW-57 (bedrock)	6	5	4	6	13	29	7	8	10

Concentrations of Benzene in Sentinel Well Pair MW-56 and MW-57 (2007-2012)

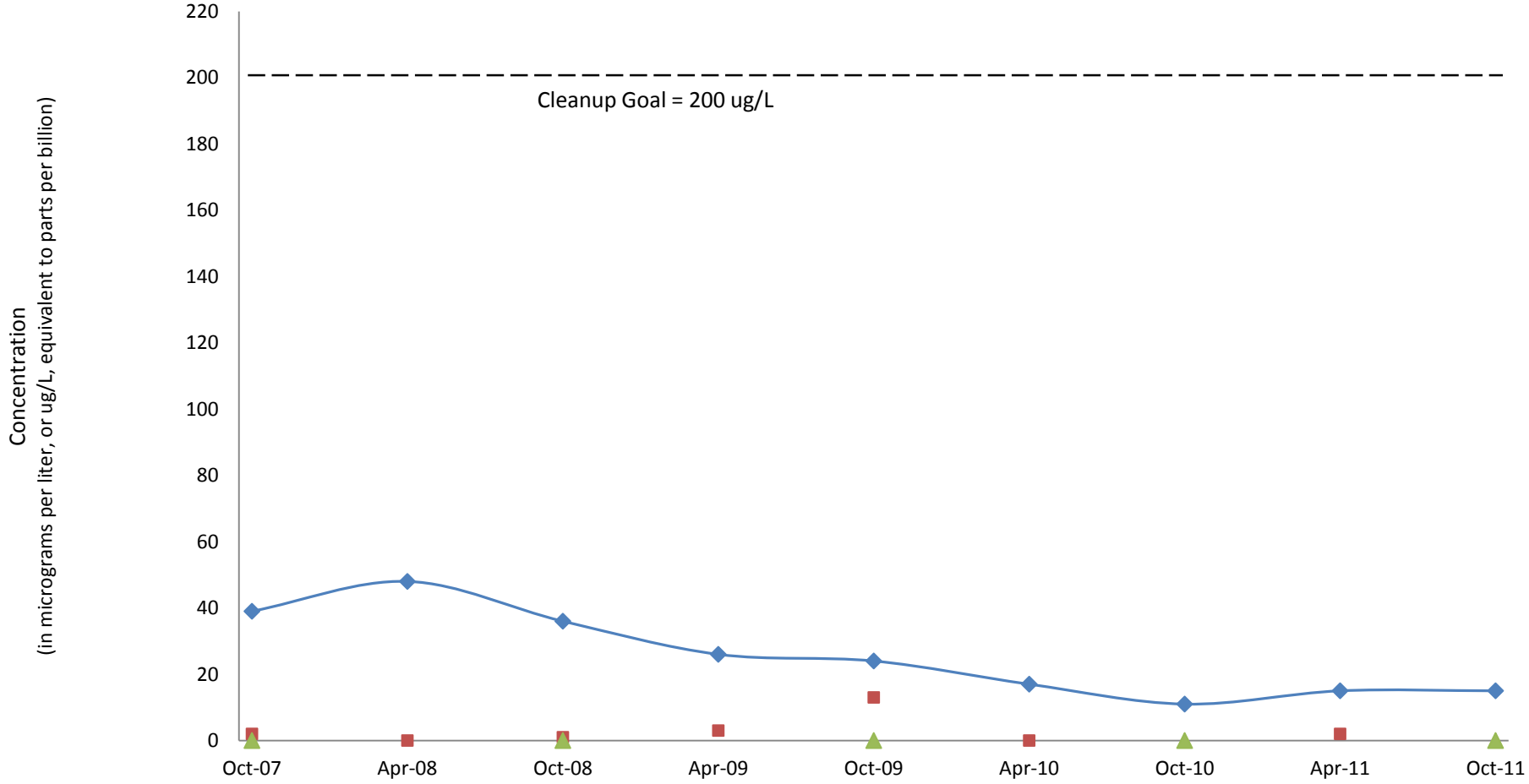


	Oct-07	Apr-08	Oct-08	Apr-09	Oct-09	Apr-10	Oct-10	Apr-11	Oct-11
MW-56 (overburden)	2	12	1	8	9	100	6	14	8
MW-57 (bedrock)	2	19	5	26	42	160	4	29	31

Attachment 7

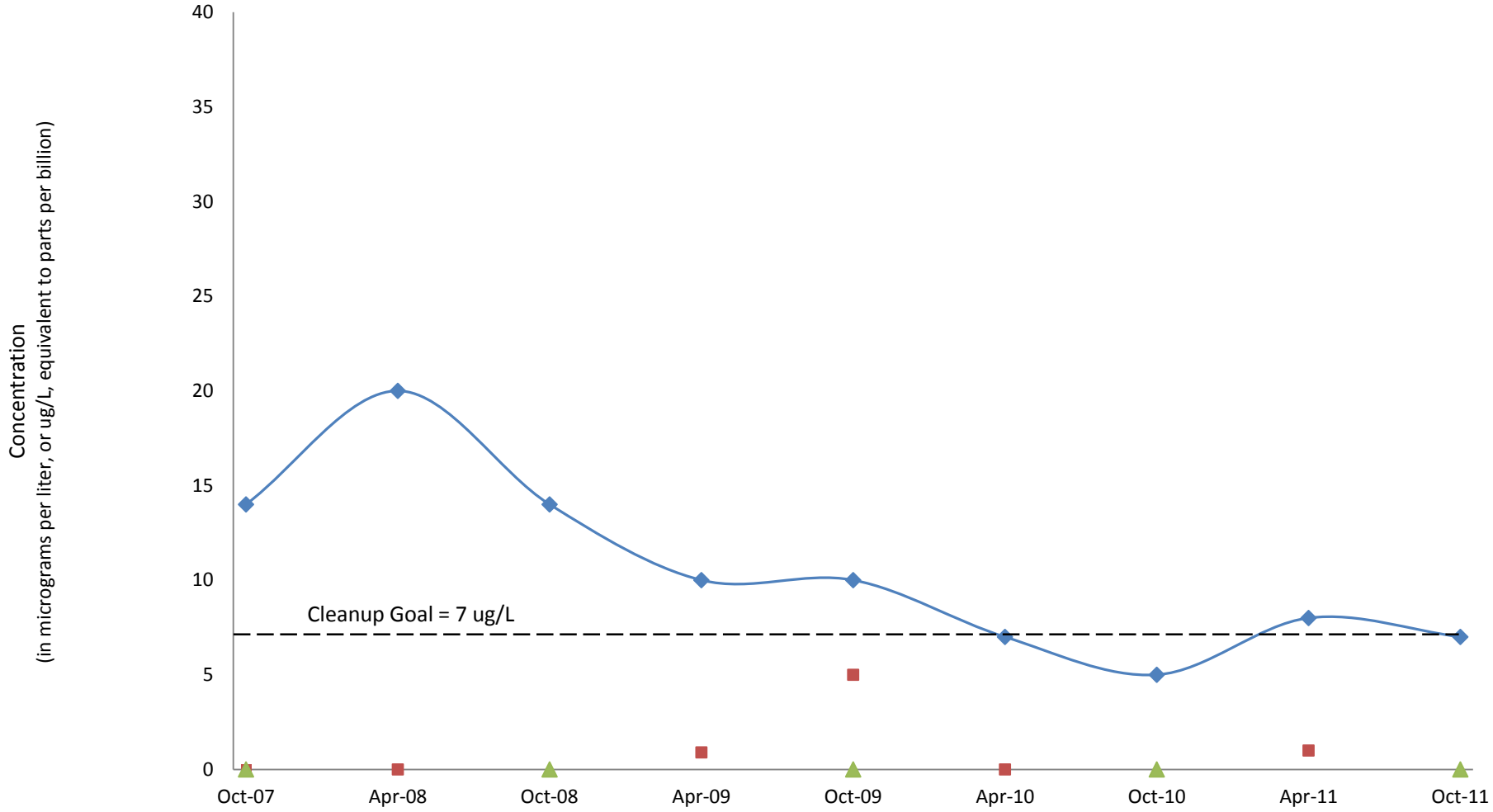
Concentrations of Volatile Organic Compounds in Southern Plume Perimeter Monitoring Wells MW-05, MW-35, and MW-29

Concentrations of 1,1,1-TCA in Perimeter Well Triplet MW-05, MW-35, and MW-29 (2007-2012)



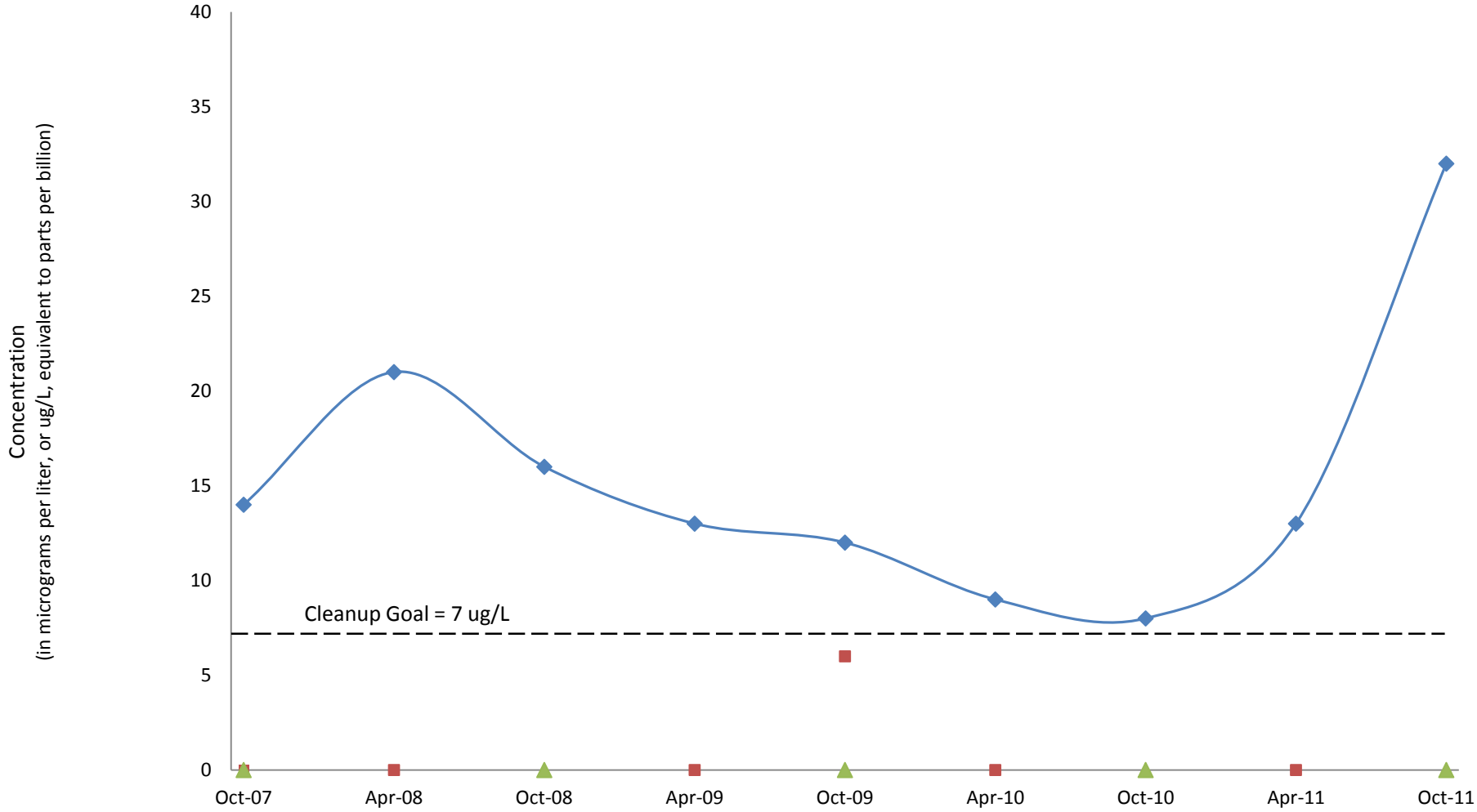
	Oct-07	Apr-08	Oct-08	Apr-09	Oct-09	Apr-10	Oct-10	Apr-11	Oct-11
MW-05 (overburden)	2	0	1	3	13	0	0	2	0
MW-35 (bedrock)	39	48	36	26	24	17	11	15	15
MW-29 (deep diabase)	0		0		0		0		0

Concentrations of 1,1-DCE in Perimeter Well Triplet MW-05, MW-35, and MW-29 (2007-2012)



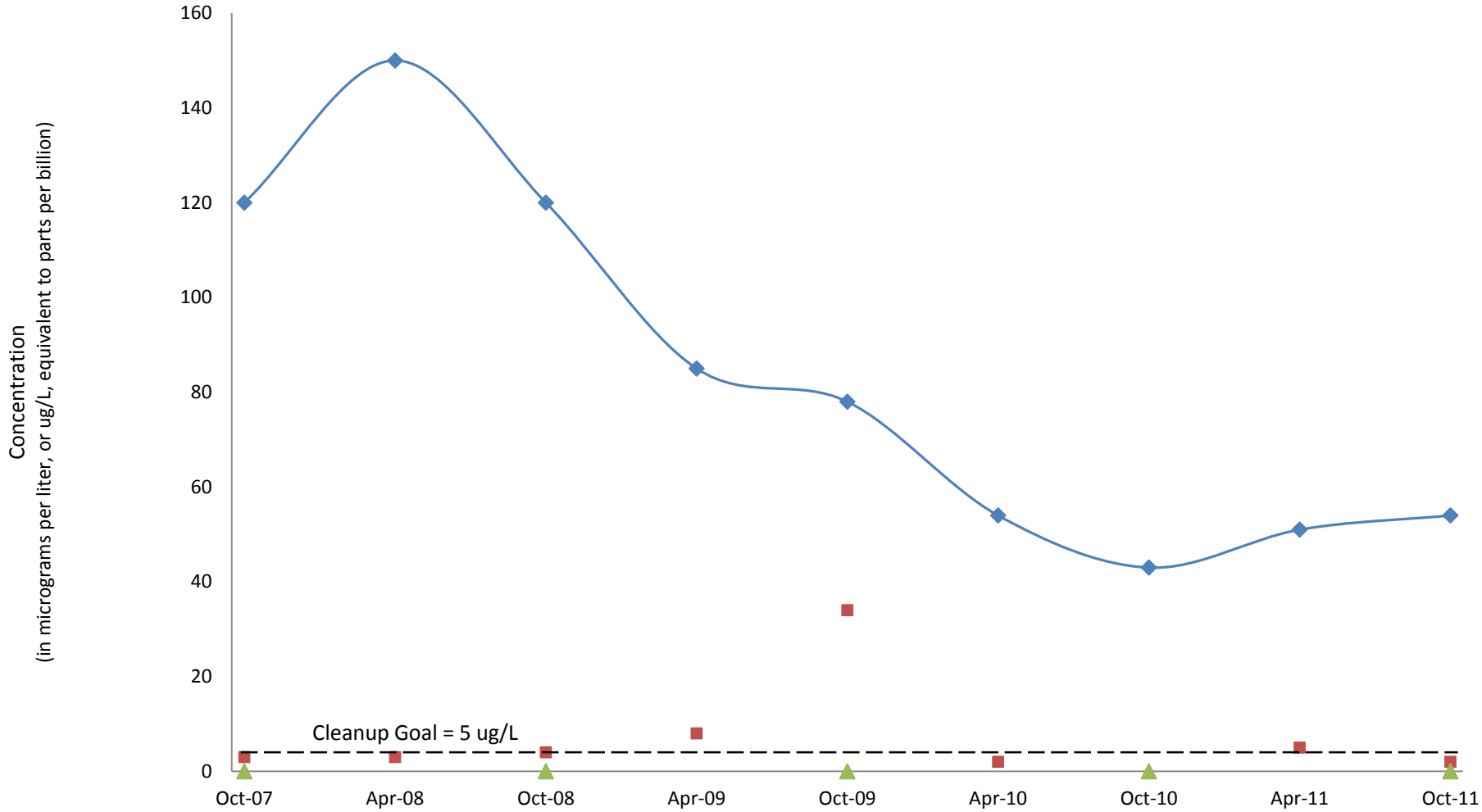
	Oct-07	Apr-08	Oct-08	Apr-09	Oct-09	Apr-10	Oct-10	Apr-11	Oct-11
MW-05 (overburden)	0	0	0	0.9	5	0	0	1	0
MW-35 (bedrock)	14	20	14	10	10	7	5	8	7
MW-29 (deep diabase)	0		0		0		0		0

Concentrations of cis-1,2-DCE in Perimeter Well Triplet MW-05, MW-35, and MW-29 (2007-2012)



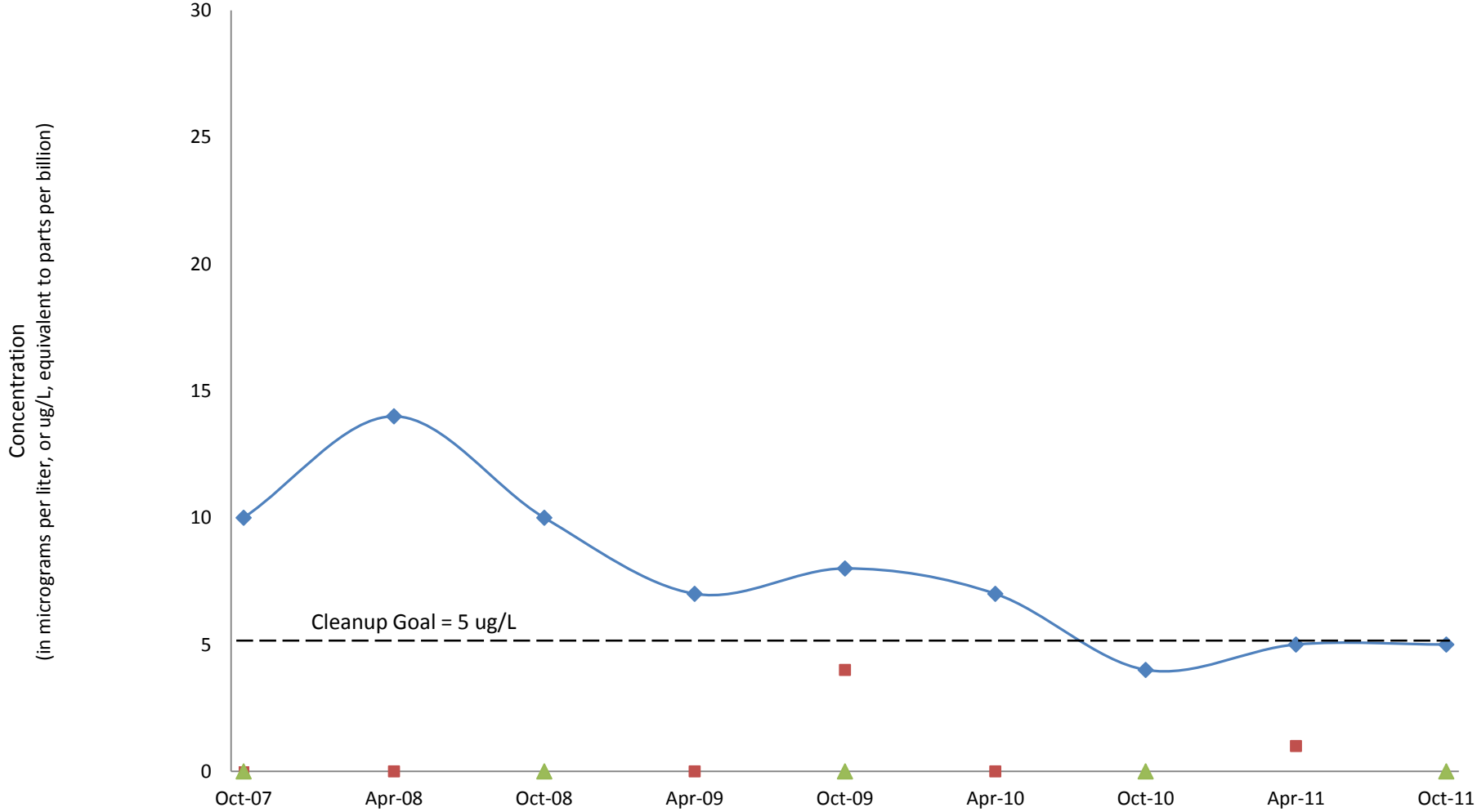
	Oct-07	Apr-08	Oct-08	Apr-09	Oct-09	Apr-10	Oct-10	Apr-11	Oct-11
MW-05 (overburden)	0	0	0	0	6	0	0	0	0
MW-35 (bedrock)	14	21	16	13	12	9	8	13	32
MW-29 (deep diabase)	0		0		0		0		0

Concentrations of TCE in Perimeter Well Triplet MW-05, MW-35, and MW-29 (2007-2012)



	Oct-07	Apr-08	Oct-08	Apr-09	Oct-09	Apr-10	Oct-10	Apr-11	Oct-11
MW-05 (overburden)	3	3	4	8	34	2	0	5	2
MW-35 (bedrock)	120	150	120	85	78	54	43	51	54
MW-29 (deep diabase)	0		0		0		0		0

Concentrations of PCE in Perimeter Well Triplet MW-05, MW-35, and MW-29 (2007-2012)

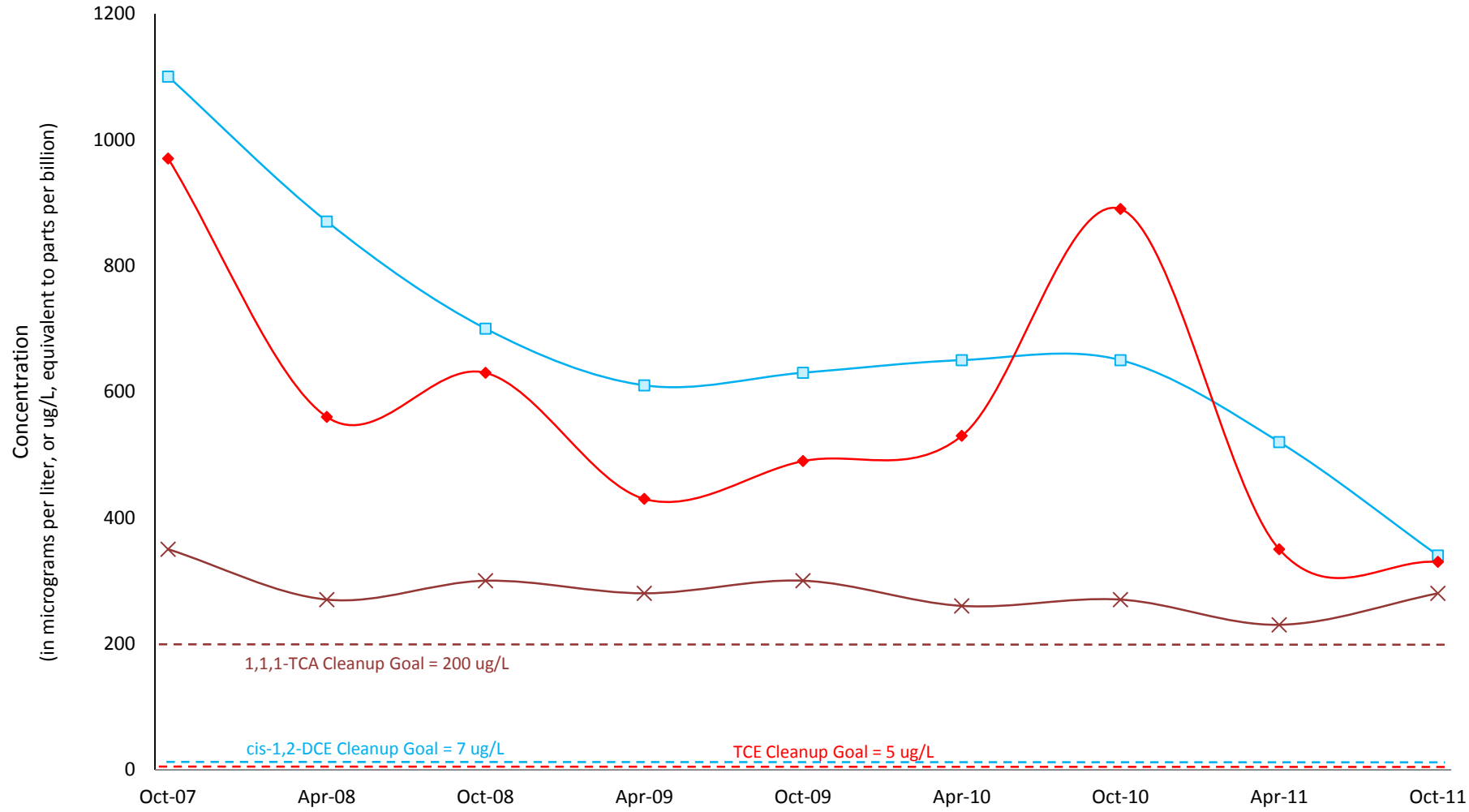


	Oct-07	Apr-08	Oct-08	Apr-09	Oct-09	Apr-10	Oct-10	Apr-11	Oct-11
MW-05 (overburden)	0	0	0	0	4	0	0	1	0
MW-35 (bedrock)	10	14	10	7	8	7	4	5	5
MW-29 (deep diabase)	0		0		0		0		0

Attachment 8

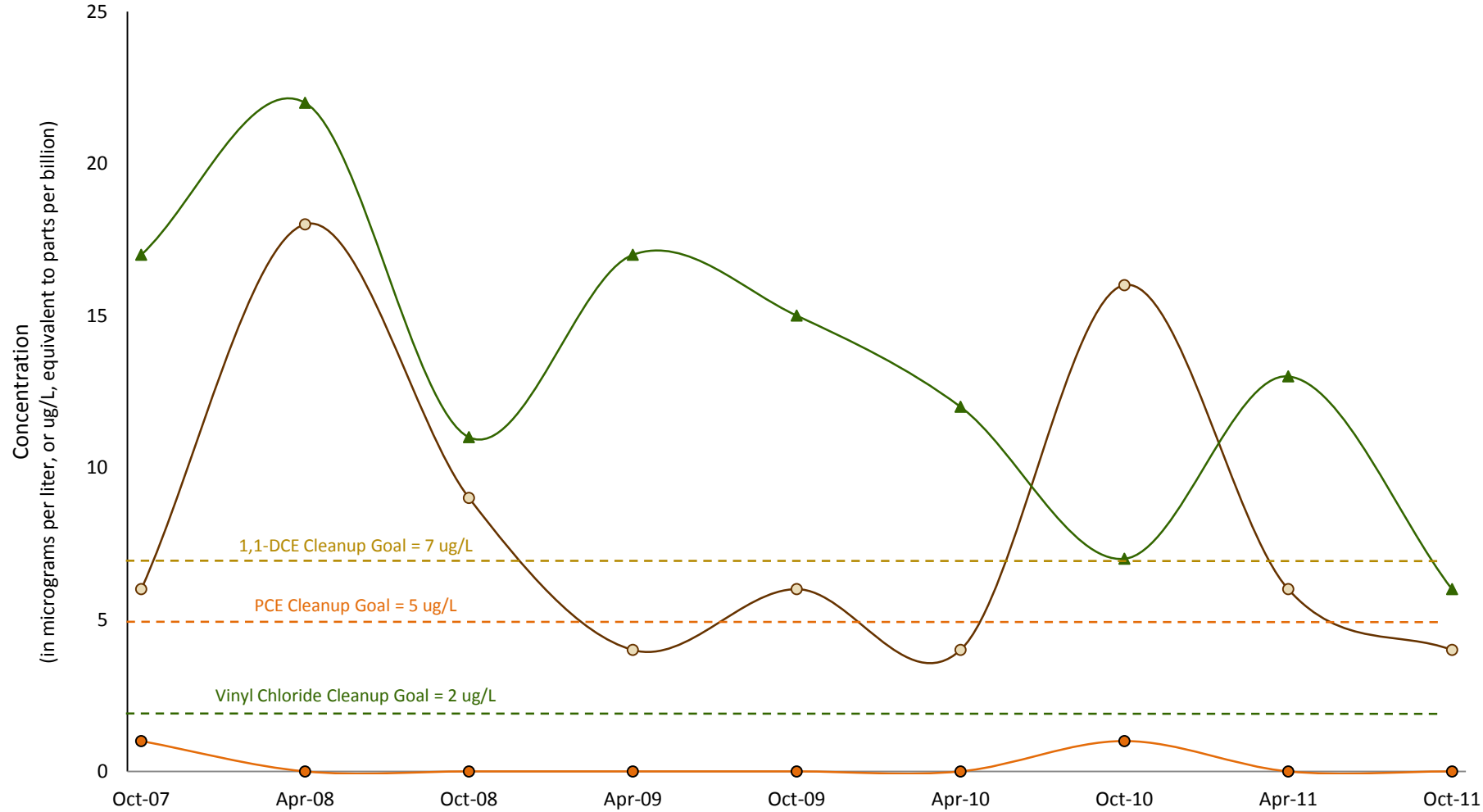
Concentrations of Volatile Organic Compounds in Sentinel Monitoring Well MW-23

Concentrations of 1,1,1-TCA, cis-1,2-DCE, and TCE in Sentinel Well MW-23 (2007-2012)



	Oct-07	Apr-08	Oct-08	Apr-09	Oct-09	Apr-10	Oct-10	Apr-11	Oct-11
1,1,1-TCA	350	270	300	280	300	260	270	230	280
cis-1,2-DCE	1100	870	700	610	630	650	650	520	340
TCE	970	560	630	430	490	530	890	350	330

Concentrations of 1,1-DCE, PCE, and Vinyl Chloride in Sentinel Well MW-23 (2007-2012)



	Oct-07	Apr-08	Oct-08	Apr-09	Oct-09	Apr-10	Oct-10	Apr-11	Oct-11
1,1-DCE	6	18	9	4	6	4	16	6	4
PCE	1	0	0	0	0	0	1	0	0
VC	17	22	11	17	15	12	7	13	6

[This page left intentionally blank.]